THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. CXI. No. 2468.] LONDON, AUGUST 30, 1910. [62ND YEAR. PRICE 6d.

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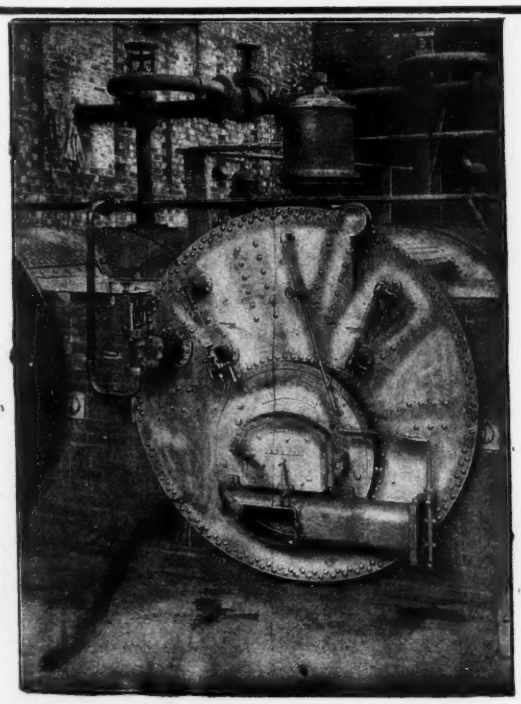

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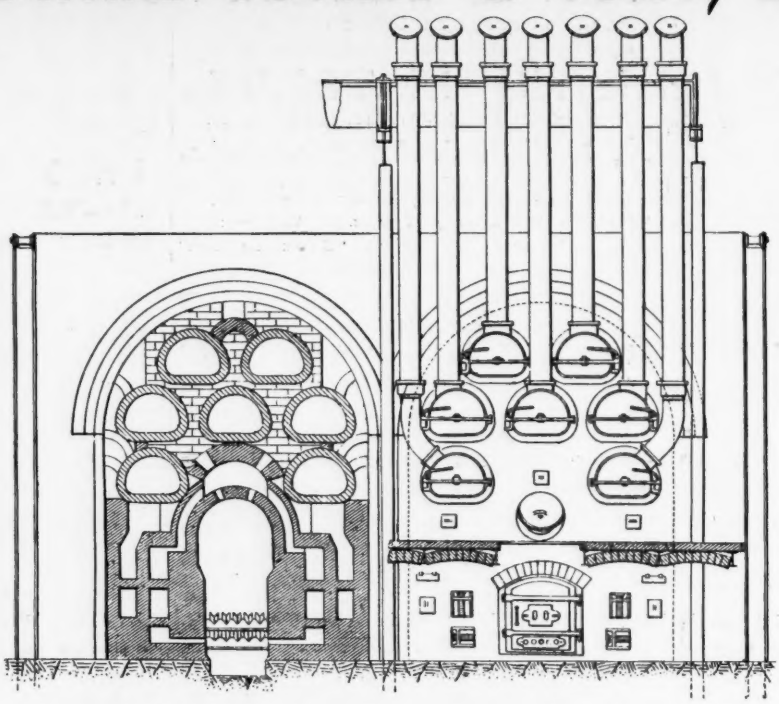

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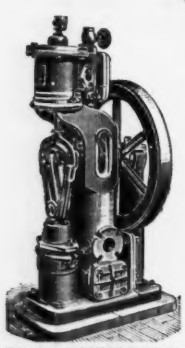

Fig. 708. "SINGLE RAM" STEAM-PUMP.

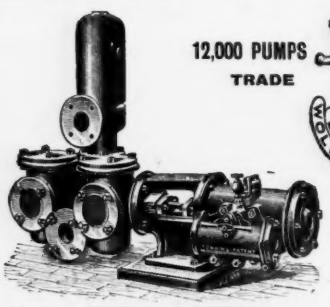

Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

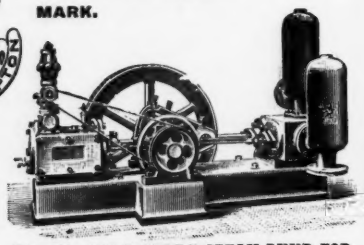

Fig. 685. "RELIABLE" STEAM PUMP FOR TAR AND THICK FLUIDS.

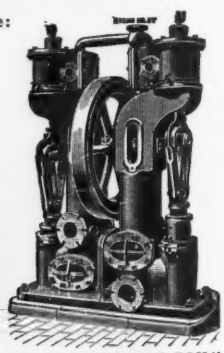

Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

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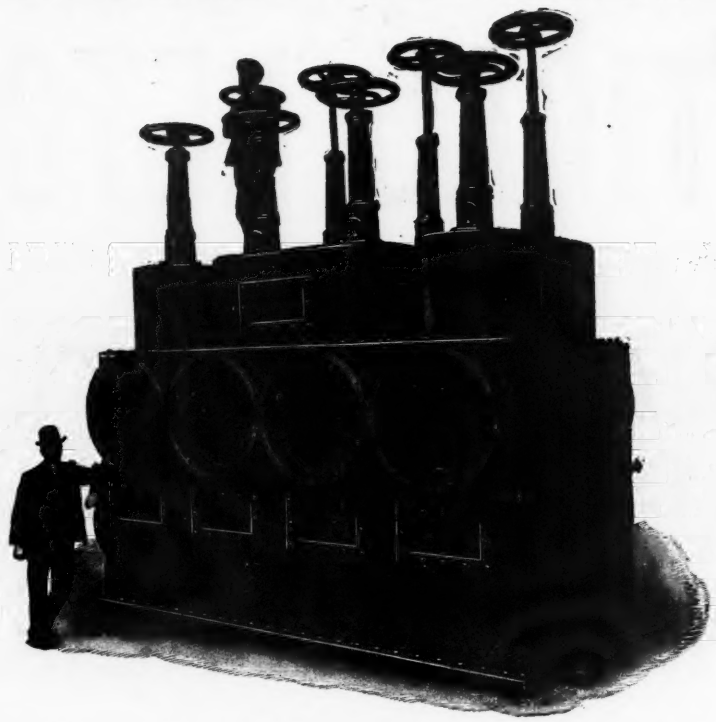

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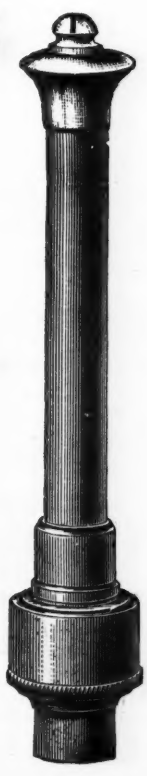

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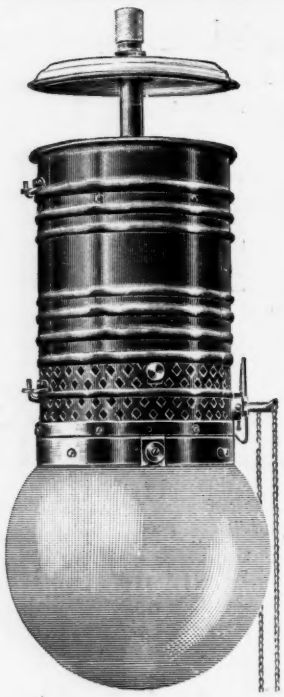

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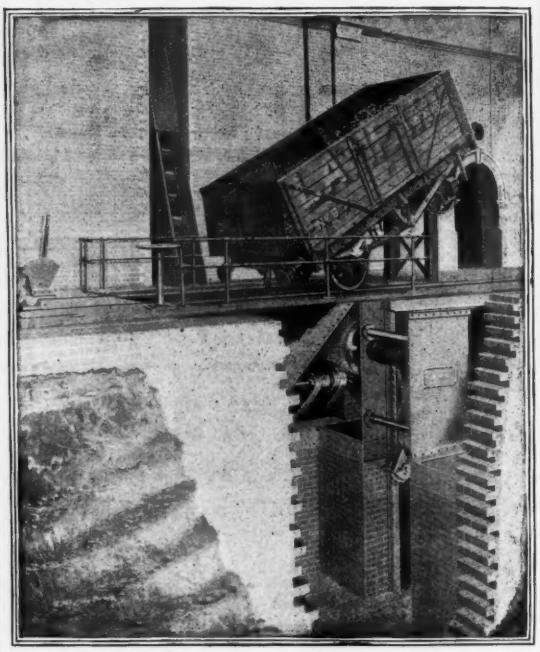

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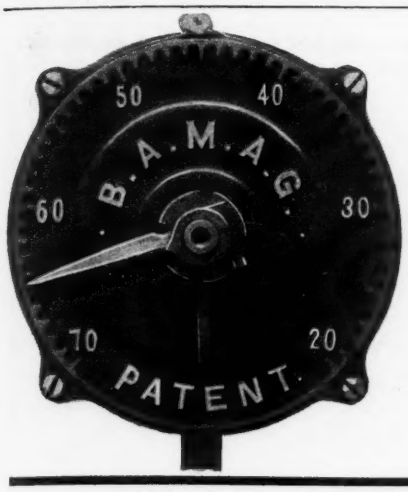

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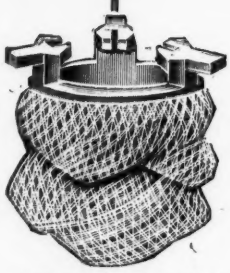

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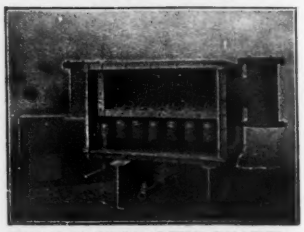

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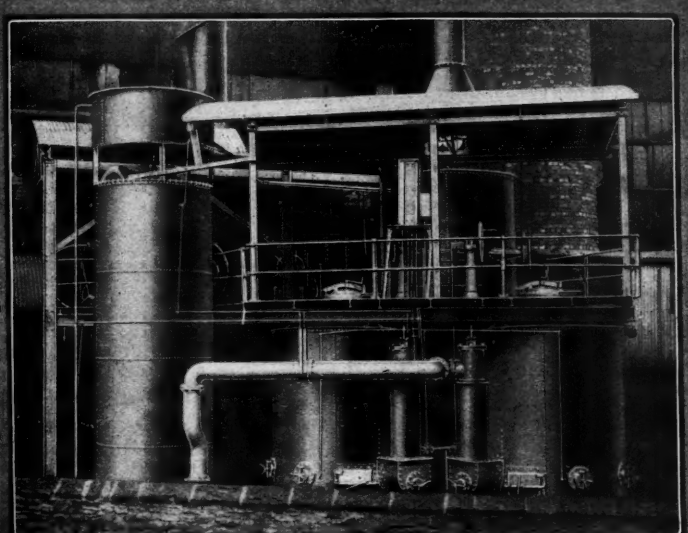

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Bromley	1,500,000	Lawrence, Mass.	400,000	Staines	600,000
Bruges, Belgium	200,000	Lea Bridge	350,000	Stettin, Germany	880,000
Brussels—Anderlecht	350,000	Lea Bridge (2nd)	350,000	Stockholm	1,500,000
Brussels—Anderlecht (2nd)	350,000	Lea Bridge (3rd)	400,000	Stockholm (2nd)	1,750,000
Brussels—Forest	1,000,000	Lea Bridge (4th)	1,000,000	Stockport	600,000
Brussels—Koekelberg	1,000,000	Leeuwarden, Holland	400,000	Stockport (2nd)	600,000
Brussels—St. Gilles	1,000,000	Leiden, Holland	500,000	Stockport (3rd)	400,000
Brussels—St. Josse	1,000,000	Leiden (2nd)	575,000	Stockton-on-Tees	500,000
Brussels—St. Josse (2nd)	600,000	Leigh, Lancs.	350,000	Swansea	750,000
Brussels—St. Josse (3rd)	775,000	Lemberg, Galicia	260,000	Swansea (2nd)	1,000,000
Brussels—Ville	750,000	Lemberg (2nd)	500,000	Swansea (3rd)	450,000
Brussels—Ville (2nd)	750,000	Liége, Belgium	1,000,000	Swindon	300,000
Brussels—Ville (3rd)	1,500,000	Liége (2nd)	750,000	Swindon (2nd)	450,000
Brussels—Ville (4th)	350,000	Lincoln	500,000	Sydney—Harbour	500,000
Bucarest, Roumania	1,100,000	Liverpool	3,500,000	Sydney—Harbour (2nd)	500,000
Budapest, Hungary	50,000	Liverpool (2nd)	4,500,000	Sydney—Mortlake	500,000
Budapest (2nd)	1,750,000	Liverpool (3rd)	750,000	Sydney—Mortlake (2nd)	500,000
Carlisle	600,000	Longton	600,000	Syracuse, N.Y.	850,000
Carlsruhe, Germany	500,000	Louvain, Belgium	800,000	Taunton	225,000
Chigwell	350,000	Lübeck, Germany	400,000	Taunton (2nd)	350,000
Chorley	300,000	Maastricht, Holland	200,000	The Hague Holland	1,000,000
Commercial, London	850,000	Magdeburg, Germany	1,400,000	The Hague (2nd)	500,000
Commercial (2nd)	850,000	Maidenhead	225,000	Tilburg, Holland	400,000
Commercial (3rd)	1,250,000	Maidenhead (2nd)	225,000	Torquay	350,000
Commercial (4th)	2,000,000	Maidstone	500,000	Tottenham	750,000
Copenhagen	700,000	Malines, Belgium	500,000	Tottenham (2nd)	750,000
Copenhagen (2nd)	2,500,000	Malmö, Sweden	350,000	Tottenham (3rd)	350,000
Courtrai, Belgium	250,000	Malta	400,000	Tottenham (4th)	1,000,000
Coventry	600,000	Manchester	3,500,000	Tottenham (5th)	1,000,000
Coventry (2nd)	600,000	Manchester (2nd)	3,500,000	Tottenham (6th)	1,250,000
Cracow, Galicia	200,000	Mansfield	330,000	Tunbridge Wells	1,000,000
Cracow (2nd)	200,000	Marlborough	100,000	Utrecht, Holland	1,000,000
Crefeld, Germany	500,000	Mayence, Germany	700,000	Utrecht (2nd)	1,000,000
Croydon	1,250,000	McKeesport, Pa.	500,000	Verviers, Belgium	1,000,000
Croydon (2nd)	625,000	Merthyr Tydfil	300,000	Vienna	3,500,000
Croydon (3rd)	625,000	Middlesbrough	1,250,000	Vienna (2nd)	2,500,000
Croydon (4th)	550,000	Namur, Belgium	175,000	Waltham	400,000
Debreczin, Hungary	100,000	Nelson	400,000	Wandsworth & Putney	1,800,000
Deventer, Holland	150,000	Newburgh, N.Y.	600,000	Watford	300,000
Deventer (2nd)	200,000	New York	5,200,000	Watford (2nd)	350,000
Dorking	150,000	Nictheroy, Brazil	250,000	Wellington, N.Z.	350,000
Dublin	2,000,000	North Middlesex	150,000	West Bromwich	550,000
Dublin (2nd)	2,000,000	North Middlesex (2nd)	200,000	West Ham	1,500,000
Dublin (3rd)	650,000	North Middlesex (3rd)	75,000	West Ham (2nd)	800,000
Dundee	1,500,000	Norwich	1,000,000	Weston-super-Mare	350,000
Dunedin, N.Z.	150,000	Norwich (2nd)	300,000	Weston (2nd)	350,000
Dunedin, N.Z. (2nd)	275,000	Norwich (3rd)	500,000	Wexford, Ireland	100,000
Durham	200,000	Nottingham	1,000,000	Wiesbaden, Germany	850,000
Düsseldorf, Germany	1,000,000	Nottingham (2nd)	1,000,000	Winchester	225,000
Eastbourne	1,250,000	Nuneaton	125,000	Winchester (2nd)	125,000
Edinburgh	2,000,000	Oberhausen, Germany	175,000	Wolverhampton	1,500,000
Epsom	225,000	Oldenburg, Germany	200,000	Zwolle, Holland	200,000
Epsom (2nd)	300,000	Ostend, Belgium	100,000	Zwolle (2nd)	200,000
Essen	1,400,000	Ostend (2nd)	200,000		

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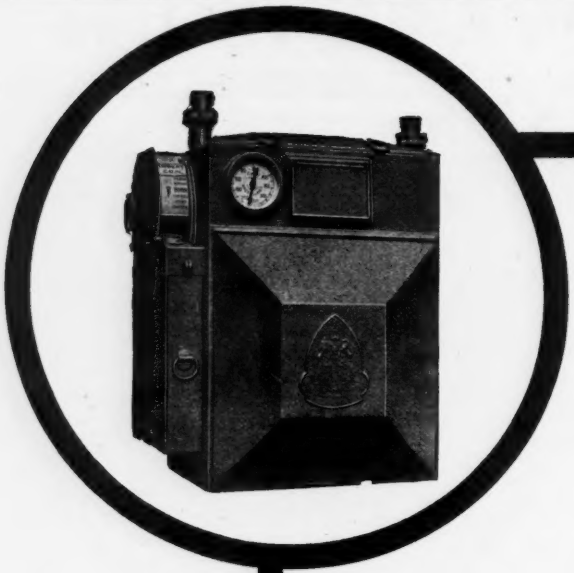

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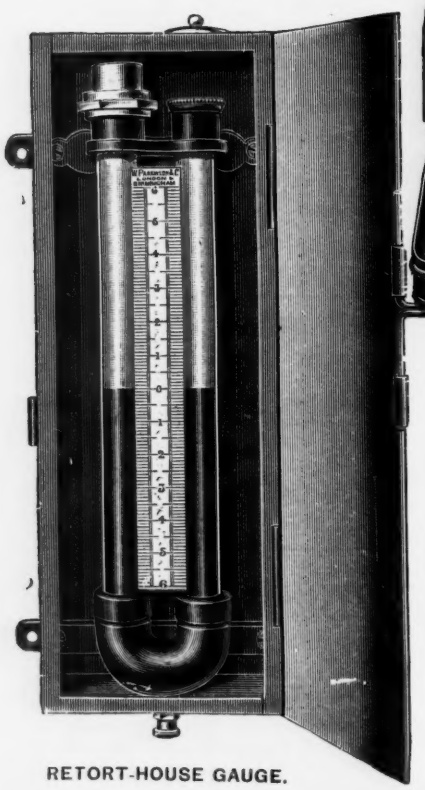

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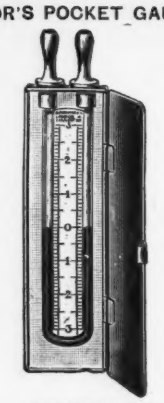
Fig. 6.



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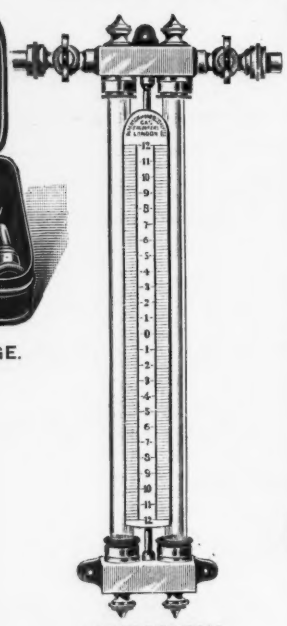

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Fig. 5B.

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EDITORIAL NOTES—GAS, &c.

The March of the Inverted Burner in Public Lighting.

ONE of the notable features in the change of our conditions in the gas industry is the fierce competition that now exists with electricity for the lighting of the public thoroughfares. The change has become more pronounced with the advent of the metallic filament lamp; but just as the gas industry was able, in the days when the carbon filament lamp represented the only small unit of the electrical industry, to maintain precedence far ahead in economy and efficiency by the aid of the vertical incandescent burner, so now it is in a position to well maintain the lead in both respects with the rival that is more effective than the carbon filament lamp, by the aid of the improved inverted burner. But with the economies introduced by the metallic filament lamps on the side of the electrical industry, and with the favour extended to public lighting by electricity suppliers in the matter of price per unit, it has to be recognized that—though inverted gas-burners have introduced material economies in the matter of consumption and mantle maintenance, the attendance required is rather more costly to keep them to a high standard of efficiency—the profit obtained per point of lighting cannot be continued on the old scale. In calculating the balance of financial advantage from the public lights, things must be taken not as they once were, but as they are. Some provincial quotations we have seen for new gas-lighting contracts in competition with electricity, do not suggest that the change in circumstances has had sufficient consideration; but they do suggest that an attempt is being made to secure the same amount of ultimate profit as heretofore. This is a pity and a mistake. Electricity suppliers are anxious to possess the public lighting. That is plain on all hands. The gas industry cannot dictate to the electrical industry how they shall conduct their business in this direction, any more than the gas industry will brook interference from the electrical industry regarding the way they shall conduct their business in the same direction. The standard set by the attacking force must therefore be accepted—however little it is liked—as the one below which the gas industry must show an appreciable margin of economy, in addition to some higher efficiency; otherwise, if there is a close approximation of prices for even a rather lower candle power, there is no doubt the craving for change, combined with the influences brought to bear, will produce a good many votes in local council chambers in favour of electric light.

The inverted gas-burner has given us a grand instrument for satisfying the craving for change; and there is no question as to the enhanced attractiveness produced by such change in the streets. The public have all along been accustomed to seeing the street gas-lamps fitted with vertical burners. Formerly, there was the flat-flame burner shooting straight up from the central stand-pipe of the street lamp. When the incandescent burner came along, the only change in fitting was the replacing of the flat-flame burner by the vertical incandescent one. The light was more brilliant, of a different colour, and the illumination of the thoroughfares was substantially improved. But the inverted burner makes a complete change in the appearance of the lamp head; and there is no question as to the great enhancement of the illuminating effect in the streets. We have turned from many main streets in South London in which the South Metropolitan Company have converted the lamps from vertical to inverted burners into side streets illuminated by the upright form, similar to those that formerly did duty in the main thoroughfares; and the difference between the illuminating effect in the main streets and those still lighted by upright burners is very marked. The public know nothing of photometers, nor do they care for the angles at which illumination may be measured, nor have they any respect for candle-feet; but the public can judge of illuminating effect. And the illuminating effect to be obtained by the inverted gas-burner far and away exceeds that to be realized by upright incandescent gas-burners, or the electric metallic filament lamp. The local public were some time since (as the "JOURNAL" at the time showed) allowed to judge of this in a main thoroughfare at Beckenham; and the public voice was distinctly in favour of the inverted gas-burner. A long contract for street lighting consequently went to the Gas Company. The public (if not under a despotic local authority) has to be pleased; the illuminating effects in the streets must be improved; the local authority (if a conscientious one) wants to show that the improvement is being obtained economically—it may be at even a reduced cost per mile of thoroughfare. And all this has to be accomplished, keeping in mind that the competitor at the heels of the gas industry is in a more favoured position than ever before for making attacks upon the superior advantages of gas. We have the whip hand; and it has to be retained. This can only be done by keeping a well-defined space between the competitor and ourselves.

The march in favour of the inverted incandescent burner for public lighting has been magnificent. Before the Metropolis took it up to any extent, the Provinces led the way. Edinburgh was a notable example; and many other places followed, but rather in a tentative fashion. The work that has been done in London during the last two or three years, however, and more especially the recent eminent successes in competition, have given a fillip to the use of the inverted burner as an effective weapon with which to fight the latest that the electrical industry can do, in both high-power and low-power units. The march in favour of the inverted gas-burner is really something of which the industry may well be proud. In the Metropolis, we have had in recent times, in the Gaslight and Coke area, the report of the deputation of the City Corporation in favour of high and low pressure inverted burners; the victory by these means in the competition for the Westminster lighting contract; the successes in retaining for a series of years the gas-lighting contracts at Hackney, Bethnal Green, and Finsbury; the happy results of the voluntary offers of the South Metropolitan Gas Company towards improved lighting in South London. In Fleet Street and New Bridge Street, the high-pressure demonstration, at a price per lamp incomparable by anything yet done by the electricians in competitive experimental work, has been effective in procuring conviction in favour of gas when flame arcs were making a bold bid for municipal favour. Let the gas industry throughout the country make use of these successes, and strike while the iron is hot. We have to recognize the improved position of the competitor; and ward gas interests by not going about the public lighting business in any half-hearted manner. The "bull" must be taken "by "the horns," especially in those cities and towns where the electricity supply is controlled by the local authority. This touches a big subject that has been discussed on many occasions, and must be bye-passed on this.

The Gaslight and Coke Company and the South Metropolitan Gas Company are notable examples of concerns that have already taken the "bull by the horns." The former Company established a gas-compressing station in Essex Street (Strand), and leading from there is now a network of high-pressure mains covering an important area. They are also establishing, for the high-pressure lighting in the West-end, a compressing-station in Horseferry Road, and, with the least possible inconvenience to the public, are carrying steel tubes for the conveyance of the high-pressure gas therefrom through Victoria Street, Parliament Square, on to Piccadilly Circus, Regent Street, St. James's Street, and other arteries of the West-end. There is recognition in this that a gas company must lay themselves out for the supply of the higher power sources of light to satisfy the favour among local authorities that has been created for high-power sources by the flame arc lamp. We may preach to local authorities about the propriety of low-power sources of light at frequent intervals for the gaining of uniformity in illumination; and the breath and trouble expended in so

doing might just as well be expended in trying to impress the same views on a brick wall. Local authorities have their own notions. They are the customers; and the shopmen must meet their views if they want to do the business. Both the Gaslight and the South Metropolitan Companies have made, and are making, offers, too, by which the initial expense of conversion from vertical burners to the inverted type does not fall onerously on the local governing body. And this initial expense is much lighter than is that of the conversion of the vertical incandescent gas-burnered lamp to the use of the electric metallic filament. If the news columns of the "JOURNAL" are looked through for the past few months, the inclusive terms on which lighting and maintenance is being done north and south of London—per lamp of different powers—will be found in the several recorded successes of the inverted burner in public lighting. With the savings in gas consumption and in upkeep of mantles, though attendance costs a trifle more, reductions in annual running expense, with additional illuminating power, can be offered. But in regard to attendance, care must be exercised in selecting types of inverted burners that are appropriate for street lighting in the matters of reliability, easy regulation, and maintenance. Just anything that is called an inverted gas-burner will not do for the purpose. If attention be paid to this, it will be found that lamps can be supplied, as in the cases north and south of the Thames quoted in our columns of late, at a lower cost than using the vertical form of burner, with a large gain in illuminating power and pleasing effect. And not only can this be shown, but it can be proved to local authorities that the cost per mile of lighting is considerably below anything that can be done, on a commercial basis, by electricity. In Hackney, for example, the cost of lighting 20·94 miles of streets by electricity works out to £377 per mile; while under the new contract with the Gaslight and Coke Company, for lighting 85·56 miles of streets with inverted gas-burners, the cost will be the very moderate one of £74 per mile.

The march to success of the inverted burner in public lighting is already most remarkable; and we look to receive reports in the near future from all over the country of success upon success. We know that an effort is to be made in the autumn to stimulate the energy of our electrical competitors in their efforts to obtain possession of fresh public lighting territory. To be forewarned, is to be forearmed.

External Labour Influences.

DURING the past week, labour questions have had a large share of attention in the public press owing to a meeting of the Joint Board (representing the Parliamentary Committee of the Trades Union Congress, the Labour Party, and the General Federation of Trades Unions) who have been considering the action to be taken in connection with the judgment of the House of Lords in the Osborne case, and through the issue of the *agenda* for the forthcoming Trades Union Congress, as well as the publication of the Board of Trade returns relating to the hours of labour worked, and the rates of pay to labour, during the year 1909. Being so largely dependent upon labour, the gas industry cannot, as having part in the conditions of which there should be administrative cognizance, afford to ignore the trend of questions affecting labour. There are few industries that are so self-contained that external labour eruptions have no adverse effect upon them; and the gas industry is not by any means, at any time, immune from the effects of current external labour circumstances. In the gas industry, on the whole, we may rejoice in contented labour; but beyond its pale, for some time past, there has been an almost constant manifestation of seething discontent in the ranks of labour generally, and particularly in those branches upon which there has to be reliance for the maintenance of supplies. Disorganization in industries that are contributory to the success or otherwise of the gas industry naturally leads, in more ways than one, to greatly increased expense and anxiety; and this, in turn, has an evil influence upon the prosperity of the industry in its relations with its patrons for the prime commodity. The troubles produced by the Coal Mines (Eight Hours) Act, for example, occasioned increased expense through the provident laying-in of extra stores of raw material as some protection against any protracted rupture between the coal owners and the miners. The working of the Act has likewise resulted in a tangible advance in the cost of coal; and there is no certainty that the end in this respect is yet in sight. This is one instance only of the mischievous results to the gas industry (among others) of labour unrest, of labour legislation, and of agitation beyond its own borders.

It cannot have failed to have struck the observers of labour events that the manifestations of labour discontent in the industrial world outside the gas industry have been more frequent and poignant since the labour unions gave themselves up body and soul to the socialistic faction; and industry and the country generally have grave cause to regret this alliance, with its intolerable pernicious suasion upon the mind of labour. We are asked to believe that the Labour Party "is an honest and honourable alliance between trade "unionism and socialists; and as such it has its advantages "and its disadvantages." From the points of view of industry and the common weal, we see much more of the disadvantages than the advantages; and some of the first-fruits of the introduction of the more militant spirit imparted by socialism have been the illustrations northward, among railway employees and coal miners, of defiance by the rank-and-file of the authority of their Union leaders. The men appear to have reached a stage in militant action when they are ready to violate contracts on the slightest provocation, and to abuse the authority of those whom they have put in administrative command over them. It is one of the grave industrial signs of the times; and therefore in this alliance between the labour unions and the socialistic element, we cannot see anything that can be constructive of good, but rather can we see much that will be destructive. A statement that was issued last week by a majority of the Council of the Independent Labour Party said, among much else, that one of their desires "is to make socialism a constructive thing that "expresses and embodies itself in every extension of public "ownership, in every wise extension by the State of the "regulation of industry, in every law that curtails the greed "of vested interests, and increases human happiness and "freedom." It is a route without end that these socialistic fanatics have selected by which to increase the sum of human happiness and freedom; and all their colossal castles in the air, all their strenuous effort, all their verbiage designed to appeal to the untutored mind, and with no vestige of sense in it, can only end without constructive value. And the communities are tiring of public ownership, which has proved its limits and its susceptibility to dangerous abuse; therefore there is no call on the part of majorities in the communities for any extension of municipal activities or for the nationalization of large undertakings that have been built up by private enterprise.

But the great thing for the moment before the labour-socialist alliance is the recommendations published last week by the Joint Board, referred to in the opening of this article, that heaven and earth should be moved to annihilate the judgment of the House of Lords in what is known as the Osborne case, which has made void the assumed power of the trades unions to call for a compulsory levy upon their members to support parliamentary and municipal electoral activity and for the maintenance of representative members in Parliament. The decision has already weakened trades unions to such a degree, and has so immeasurably loosened the hold of the leaders over the members, that there is a desire among those who sit in the high places of trades unionism and socialism to effect legislation to invalidate the judgment of the House of Lords, and to "restore" to the unions something that they at one time exercised but never possessed the legal right to so exercise. We need not enter here into the methods by which it is proposed to stimulate agitation on the subject and (may we also say?) coerce the Government into compliance with their wishes. All this has been set out fully in the daily press; but in this question, there is the seat of a possible great labour disturbance with the object of bringing pressure to gain the end that is being sought. The matter is to be agitated and discussed throughout the country and at the forthcoming Trades Union Congress. But the agitators have before them a sheer-faced obstacle in the reluctance of the Government to do anything to invalidate the judgment of the House of Lords, though prepared to consider some alternative proposal, such as the payment of members. But the Government have this on their side, that since the judgment the Trades Unions have tried the effect of a voluntary contribution in place of a compulsory one, and it has ignominiously failed. This is conclusive proof that the rank-and-file of unionism are not in complete accord with their leaders in this matter; and only compulsion will effect the end. The leaders are talking about the "freedom" of labour! It is freedom in chains for the

men! The Government, on the other hand, cannot afford to lose the prop of the Labour Party; and their dilemma is not a light one. Already the Labour Party have a grievance against the Government. They are crying out against the Labour Exchanges created by the latter—not because they have been the means of finding employment (at large expense) for thousands of unemployed, but because they are antagonistic to the interests of Trades Unionism by supplying "blackleg" labour when trades unionists are in disagreement with their masters. Is it possible to bring about composure from this fearful labour discord and chaos? We fear not by the ordinarily accepted methods. All these are matters that, through the unrest generated by them, have indirectly malign effect upon industries in which labour is satisfied and contented.

Consumption, Prices, and Capital.

THERE is before us an analysis of the accounts for the past half year of the three London Gas Companies, and five of the largest of the Suburban Gas Companies; and the figures are peculiarly interesting, in more ways than one. In the first place, it is noticed how very similar, in the majority of the districts, is the half-year's tale as to the consumption of gas (having regard only to the figures showing increase and decrease percentages). In them the consumption made comparatively small advance, or it even remained practically stationary, during the whole six months, accountable by the mildness of the first three months of the year (which affected the consumption for heating purposes), and by, it is beyond all question, the extending use of the inverted burner and the employment of the smaller units—such as the medium and the bijou types—which are causes affecting the amount consumed for lighting purposes. There are no other explanations, in view of the constant growth of connections and the diverse uses of gas, with business scope expanding in each of the latter. The increased consumption of the Commercial Company was 0·4 per cent.; Croydon had the slight decrease of 0·03 per cent.; the South Metropolitan Company marked an advance of only 0·06 per cent.; the South Suburban Company had a decline of 0·8 per cent.; while the Wandsworth and Putney Gas Company showed an increase of 0·5 per cent. But regarding the decreases shown, the substantial influence of current circumstances is shown by the fact that, though Croydon had the decline of 0·03 per cent. in the half year, the weeks that have passed since June have marked progress in consumption at the rate of 8½ per cent. At one time of day, there would have been almost consternation had business at any time presented an actual decline in a half year; but now gas consumption shows such subservience to atmospheric and trade conditions that to the fickleness of consumption ascensions and declensions the gas engineer and manager who is responsible for meeting current demands has become quite accustomed.

In the extent of the risings and fallings of a gas undertaking's business barometer, local conditions play an important part. Districts cannot be found where electrical competition is keener than in those of the Brentford and the Gaslight and Coke Companies. Yet there we have the respective percentage increases of 4·2 and 1·7; and these companies are neighbours of those showing fractional percentage advances or declines. In the half year these two Companies were charging 2s. 9d. and 2s. 8d. respectively for gas, which were, with the 2s. 8d. of Croydon, the highest charges of the Companies whose accounts are analyzed. But these charges are under notice of change. It has been previously remarked that the price of gas, so long as it is kept a reasonable one, does not alone control consumption accession or otherwise, though the lower the price the more stable the foundation of the business. Then there is the Tottenham and Edmonton Company, who had a growth of consumption amounting to 5·5 per cent. In this instance, local development has been the main highway to the extraordinary growth the concern has experienced during recent years.

There is another point that is notable; and it is that, in the list before us, the Company with the smallest total consumption in the half year is the Wandsworth and Putney—viz., 547,322,000 cubic feet—and that is the Company too that was charging the lowest ordinary price during the half year (1s. 10d.), and there is now an announcement of a further decrease. But the reason for this is shown by the figures under "Fixed Capital per 1000 Cubic Feet on Half-Year's "Figures." In the case of the Wandsworth Company, the amount was down to 6s. 8¼d.; and this is 1s. 4¼d. below the next lowest—8s. 0½d. in the case of the South Metropolitan Gas Company, whose price was 2s. 2d. It is only fair to the Brentford Company, whose capital on the half-year's figures is only 1d. more per 1000 cubic feet than that of the South Metropolitan Gas Company, to say that the reason for the charge for gas being maintained at 2s. 9d. up to last half year is due entirely to the large scheme of works reorganization and renewal that the Engineer (Mr. Alex. A. Johnston) felt it incumbent upon him to advise soon after his appointment as Engineer and Manager of the Company. However, in the record (for the district) price of gas and capital costs quoted for Wandsworth, having regard to the total consumption, there are material facts over which to reflect, and which material facts give abundant gratification to the Chairman, Directors, and officers of the concern.

It has been mentioned above that local conditions have a considerable effect on the gas business of the Suburban Gas Companies, most of whose territories are the residential areas of the Metropolis. These districts have separately their periods of active growth, and then there is a slowing-down for a period; the scene of active growth being transferred elsewhere. In other words, they have in turn fat and lean years. Taking the county of Middlesex, during the past decade there has been a general growth of the population; but in some areas it was at a much greater rate than in others. The recently issued report of the Medical Officer of Health for the County shows that between 1901 and June last year, the population of Middlesex increased from 792,314 to 1,123,328. This indicates rapid migration from within to beyond the Metropolitan radius; and it also indicates the considerable expansion of the opportunity for business that has been enjoyed by the Gas Companies. But when we analyze the figures, it is found that there has not been a *pari passu* extension of the population throughout the county. Some areas in the nine years covered by the return enjoyed a 50 per cent. and more increase in population; in others, the percentage is relatively small. In the Tottenham and Edmonton, the Brentford, and the Harrow Gas Companies' districts, for example, there has been quite a luxuriant growth in population; and these Companies have been, with others, particularly fortunate in their growth of business during this period of quick extension of population. As a matter of interest in connection with the subjects dealt with in this article, we reproduce, in our "Miscellaneous "News" columns, some illustrating figures from the report referred to here. The diversity represented by them in the rates of growth of neighbouring districts presents one reason for the varied experiences of companies whose districts have quite close geographical relationship.

The British Association.

TO-MORROW and for a week after, the British Association will be meeting in Sheffield, which city has not been visited by this body since 1879. Sheffield to-day is not the Sheffield that it was then. It has meanwhile attained to an industrial splendour that the most hopeful of its citizens of thirty and odd years ago could not have anticipated. In this progress, the Sheffield Gas Company have taken part, and in a manner that has placed the Company in a position of pre-eminence in the matter of charges to their customers that can be challenged by only one undertaking in the United Kingdom. There should be opportunity during the proceedings at the meeting of the Association for bringing before the members the facts as to what the Company have done in serving the city; for truly we do not believe that, under municipal control, the undertaking would, during the period of the mania of municipal bodies for trading profits in aid of rates, have rendered service to the citizens in the handsome manner that the Company have succeeded in doing. While admittedly this is not a matter that directly hinges upon the proceedings at the meeting of the British Association, we do feel that, when the engineering and industrial features of the city are being talked of by the daily press, a feature that has a particular attraction for us, and that has had considerable influence upon the city's welfare, must not be pushed altogether out of sight.

The forecast of the proceedings at the meeting, as presented by the programme and other information, does not suggest that there will be much that will have direct claim to the notice of the gas industry. We should like to see the industry better represented at the meetings of a body whose proceedings are popularly followed as are those of the British Association. The electricity industry has found it a

good platform in their publicity campaign; and there is no reason whatever why the gas industry should not use it for making known its advances. However, it will be useless to look for much of immediate attraction in the Presidential Address of Professor Bonney, who is one of the greatest living authorities on geology, though geology has an important bearing on an industry which goes into the bowels of the earth for the greater part of the raw material that it requires. The engineering section will meet under the presidency of Professor W. E. Dalby. We are hoping in this connection to receive a further instructive report from the Committee who are collectively trying to place order where chaos has existed in connection with the study of the phenomena associated with internal combustion engines. In the chemistry section, users—such as the gas industry—of cast iron should derive from the President (Mr. J. E. Stead) some instruction on the chemical phenomena associated with the effect of sulphur and silicon on the carbon condition in commercial cast iron. We also look for Professor H. E. Armstrong's paper on the provident use of coal to be both interesting and didactic, and hope he has made note of what the gas industry is doing in this respect. In these days when the industry has so much selfish interest in taking a part in advancing the sanitary conditions of the air of our urban areas, we may find some indirect interest in the agricultural section, seeing that Dr. Crowther contemplates discoursing on the effect of the atmosphere of a town on vegetation. In the same section, Professor W. B. Bottomley and Mr. J. Golding will dilate on recent work on the fixation of nitrogen by bacteria. Sulphate of ammonia makers, with increased competition about them, and rumours of further growth ringing in their ears, will look with interest to the lines of this last-mentioned communication, but not with any alarm. Taken on the whole, however, the prospects are that there will be but a sparse harvest of educational matter for the gas industry in the proceedings of the British Association during the succeeding seven days.

Management of the Gas Supply of Paris.

It will be within the recollection of readers of the "JOURNAL" that a few years ago its columns were from time to time occupied with reports of proceedings in the Municipal Council of Paris on the subject of the supply of gas in the city. The conditions under which the service was then carried on were in striking contrast to those obtaining this side of the Channel, inasmuch as their effect was to keep the price of gas at a very high figure, while here it was just the reverse. Under the old Gas Company's concession, it was for some years thought that no change was possible. But a short time before its expiration a way out of the difficulty was found, and consumers were granted some measure of relief. When the concession came to an end, the question arose as to the best way of continuing the important public service which for half-a-century had been in private hands. Opinions were divided between direct control by the Municipality and ownership of the works by them and control by a company, subject to an annual payment. After much discussion, the latter arrangement was carried out; and it was thought the gas question would be set at rest for some time, especially as the contract entered into with the new Company—the Société du Gaz de Paris—was for 25 years. But no. One little clause in it specified that it could be terminated at any five-year period, on two years' notice being given to the Company to this effect. As they commenced operations on Sept. 1, 1907, the notice had to be given before the end of the present month. Here was an opportunity for the out-and-out municipalizers; and they found a representative in the person of a Labour member of the Municipality, who, we believe, was at one time a gas stoker. He put a long series of questions to the Prefect of the Seine with the view of obtaining information and papers on the subject of the gas supply of the city; and the report presented to the Municipality by this functionary was discussed at a special meeting. The outcome was that by a majority of 24 (47 against 23) continued confidence in the present management was voted. The decision was fully justified; for since the supply of gas has been in the hands of the Company, the make has gone up from 13,100 million to nearly 14,400 million cubic feet, and the profits from £902,840 to £960,000. Surely it is not too much to attribute this result to a combination of high technical ability with business capacity and skilful management. And yet in the course of the discussion to which reference has been made there were heard expressions to the effect that the gas supply of the city would never be perfect until it was entirely in the hands of the Council, and controlled by one of its Committees—a body consisting doubtless of worthy and well-meaning men, but absolutely unfitted, we venture to think, to undertake the duties now discharged by the Board of Directors of the Gas Company. This seems to have been the opinion of the majority of the councillors.

Some Coal Figures.

Speculation as to the possible or probable date of the exhaustion of the world's coal supply has often proved a fascinating subject for people possessed of a taste for figures; and anything more likely to excite such speculation than the annual "Coal Tables," dealing with the production and consumption of the principal countries of the world, it would be difficult to imagine. The latest issue of these tables—particulars from which will be found on another page of this number—shows that the aggregate output in 1909 of the five chief producing countries was about 860 million tons—a truly stupendous output for a period of only twelve months. Large as it is, however, and showing as it does an increase of some 23 million tons on 1908, it is still less by 36 million tons than the quantity that was raised in 1907. In the year 1908, we learn, the total known coal production of the world, exclusive of brown coal or lignite (the figures just given, of course, are only for the five principal countries), was about 950 million tons. Of this huge total, our own country contributed more than one-fourth—an achievement which, it may be mentioned, is, in the matter of amount, dwarfed by the output of the United States. When, however, the output is considered in relation to population, the United Kingdom occupies first place, with a production of coal amounting to 6 tons per head, as against the 4½ tons of the United States. In the cases of the other three of the five principal producing countries, the figures are: For Belgium 3⅕ tons, for Germany about 2¼ tons, and for France under 1 ton per head. When, on the other hand, consumption per head is considered, it is seen that the use of coal in the United States is greater in proportion to the population, as well as absolutely, than in the United Kingdom—4·14 tons per head, as against 3·96 tons, in 1908. In Germany and in France the production of coal in 1909 was greater that in any previous year; the falling off as compared with 1907 having been experienced in the cases of the United Kingdom, Belgium, and the United States. But whereas the output of this country was only 4 million tons less in the year 1909 than in 1907, that of the United States exhibits a shrinkage of something like 38 million tons. Turning to another aspect of the tables, it will be noticed that there is a wide difference in the prices for coal realized in the different countries, though, as is pointed out, the average values shown are not for coal of the same quality. The large production of 1907 was accompanied by a general increase in the price of coal at the pit's mouth; the rise in the case of the United Kingdom being from 7s. 3½d. per ton in 1906 to 9s. the year following. In 1908, only 1d. per ton of this increase was lost; the average for that year being stated as 8s. 11d. per ton. The variations were not in the same proportion in the case of the other countries; the figures for the three years for Germany being respectively 8s. 11d., 9s. 8¾d., and 10s. 3½d., while for the United States they were 5s. 9½d., 5s. 11½d., and 5s. 11¾d. per ton.

The Trades Union Congress.

As indicated elsewhere, the resolutions to be considered at the Trades Union Congress, to take place next month in Sheffield, have been published; and they are as usual of a widely varied, and often highly contentious, character. The administration of the Labour Exchanges will be considered by the delegates; and acquiescence will be asked in a proposal that the Parliamentary Committee should be instructed to frame a Bill for the purpose of legalizing the payment of salaries to members of Parliament from the National Exchequer. One resolution suggests the establishment of a central legal defence fund, to which affiliated Unions should contribute *pro ratâ*, with the object of meeting the legal costs incurred by any of the affiliated Unions in carrying to the highest legal Court any test case affecting the fundamental principles of organized labour. The question of State Insurance against accidents will be raised, on a motion that the Parliamentary Committee be instructed to press forward legislation with the object of insurance of workmen against accidents, "to take the place of the present inhuman system of insurance by private

companies." Compulsory insurance against unemployment is another matter to be dealt with. A resolution in favour of a general eight-hour day will be proposed by the National Union of Gas Workers and General Labourers. The Labour Protection League will demand a minimum wage for Government workers; and the London Society of Compositors will press for an amendment of the fair-wages clause in Government contracts, so as to provide against the employment of women on what is commonly accepted as men's work unless engaged under the same conditions and paid the same wages as men for similar work; the employment of boy labour in excess of the recognized requirements of the trade; and excessive and systematic overtime. The subject of education will be introduced in connection with several motions; and an old friend will be seen in the shape of a suggestion in favour of the adoption of a policy of nationalization of railways and canals. There are many other propositions to be submitted which need not be referred to here; but perhaps the last resolution on the list may be noted. The motion is headed "Administration of Justice," and is drawn up by the Parliamentary Committee of the Congress. It is as follows: "This Congress is of opinion that the present constitution of juries in connection with the Courts of Justice is unfair and partial, and declares that a reorganization of the system is desirable in order to ensure that all classes of the community are fairly included on jury lists; and that the system of common and special juries, based on different qualifications, be abolished; and that the matter be referred to the Parliamentary Committee to take whatever action may be deemed necessary." Altogether the delegates should have sufficient to occupy their attention during the week over which the sittings of the Congress will extend.

Personal.

Mr. SAMUEL CUTLER has been appointed a Director of the Harrow and Stanmore Gas Company, in succession to Mr. Horace J. Rydon, deceased. Mr. Cutler was an original shareholder of the Company.

Mr. PERCY BROWNE, son of Mr. A. F. Browne, of the Vauxhall Gas-Works, has been appointed Manager of the Sales Department of the Brighton and Hove General Gas Company. Mr. Browne has been in charge, under Mr. A. Stokes, the Chief Inspector, of the show-rooms and canvassing staff of the south-eastern section of the South Metropolitan Gas Company's area. There were about 300 applicants for the position, which was advertised in the "JOURNAL" for the 16th inst.

Obituary.

Mr. JOHN MARSHALL, who till about eight years ago was Gas Manager at Largs, died at the gas-works there on Sunday, the 21st inst., at the age of 65.

Messrs. Falk, Stadelmann, and Co., Limited, announce the death of Mr. A. C. TAYLOR, who had been Manager of their Glasgow branch since its opening, and was previously for a number of years associated with the Company in London.

We regret to learn of the death last Sunday of Mr. THOMAS VALE, head of the firm of Messrs. Thomas Vale and Sons, Limited, of Stourport. Deceased was known to many of our readers, not only in his business capacity, but as a Freemason. The funeral will take place at 3.45 to-morrow afternoon, at St. Mary's Church, Bishopswood, Hartlebury.

The death took place at Newport (Mon.), on Saturday, the 20th inst., at the age of 48, of Mr. ROBERT HENRY HAYNES, M.Inst.C.E., Borough and Water-Works Engineer. He studied under the late Mr. Conyers Kirby, formerly Borough Engineer of Newport, and was appointed Deputy Borough Engineer in 1883. He served the town in this position till 1893, when he was appointed Borough Engineer. Ten years later he became Water-Works Engineer. He was associated with some important municipal undertakings, including the construction of the Wentwood Water-Works. He was a member of the South Wales Institute of Engineers, the Association of Municipal and County Engineers, and the Association of Water Engineers.

Gas Committees and Free Fitting.—In the abstract of the accounts of the Stockton-on-Tees Corporation for the past municipal year, lately issued by the Borough Accountant (Mr. J. Reay), attention is drawn by the professional Auditors to an interesting point conveyed in a recent decision of Mr. Justice Neville, that corporations having statutory powers to supply electricity are not entitled to do wiring and supply fittings on customers' premises. It has been the custom for some time past for the Stockton Corporation to do certain repairs to these fittings; and the Auditors recommend that this should be discontinued, in view of the decision mentioned. They presume the decision will also embrace the gas fund of the Corporation; and if this is so, it will considerably hamper the work of the Gas Committee, who for a long time have been installing gas-stoves free.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 599.)

THE past week on the Stock Exchange—mid-week of a long account at the end of August—has not unnaturally been something like a record for its paucity of business. In the face of this, and of the hardening of the Money Market, where there was a marked scarcity of supply, the firmness with which Consols and other choice lines have borne up was remarkable. Speculative securities, of course, have oscillated. The opening day was very slack. There were many absentees, and business was featureless and uninteresting. But Consols were rather better on buying orders; and Rails, though neglected, were fairly steady. Things were just as quiet on Tuesday, but the tone was cheerful. Consols were firm, and Foreign rather good, while some speculative lines were in favour; but Americans were weak. On Wednesday, the tendency was hardly as good; but movements were inconsiderable. The weakest spot was Americans. All markets were very idle on Thursday; there being hardly enough doing to produce any shift in prices. Consols held their own, and closed firm on the Bank rate remaining unchanged. Americans swayed about uncertainly. On Friday, the mining settlement began—apparently presenting no difficulty. Almost everything was pretty good, including Americans. Thunderstorms impeded Foreign business. Saturday was very quiet; but the tendency was quite fair in almost every department. The Money Market tightened considerably, and rates for loans and for discount rose; but the tension was relaxing at the close. In the Gas Market, business was a fair average for the time of year. The tendency was quite good, and several issues (some being aided by increased dividends) advanced in quotation. In Gas-light and Coke, the ordinary was strong at from 105 to 105¾—a rise of ½. In the secured issues, the preference made from 102¾ to 104, and the debenture 80½. South Metropolitan was quiet at from 120⅜ to 122. In Commercials, the 4 per cent. was dealt in at 105½ free and 106½, and the debenture at 81. Among the Suburban and Provincial group, Alliance and Dublin debenture realized 98½, Bromley "B" 89½, British 44⅝ and 45⅛, and South Suburban at from 120 to 121⅜—a rise of 1. On the local Exchange, Sheffield "C" marked 235, and rose a point. In the Continental companies, Imperial, after changing hands specially at 177, jumped up to 185¾ on the announcement of a higher dividend. Union improved a couple of points, with business at 94½ and 95¼, European fully-paid realized 23⅞, ditto part-paid 17⅞ and 17 15/16, and Tuscan 9⅛. Among the undertakings of the remoter world, Bombay changed hands at 6¼, Cape Town preference at 5⅜, Oriental at from 139 to 140, Primitiva at 7¼ and 7⅜, ditto preference at from 5 5/32 to 5 9/32, and ditto debenture at 97½.

ELECTRICITY SUPPLY MEMORANDA.

Pitiful Continuation of Irritation—Half-Hearted Support—Views from Maidstone—Municipal Canvassing for Work for the Contractors—Conscience and Safety.

OUR electrical friends are sadly in need of something very strong to alleviate the irritation which continues among them over the street-lighting successes in London. They cannot forget the shocking rebuff they have sustained in the public eyes after all their vain-glorious pretensions; and they cannot bring themselves to make the formal recantation. Whether they do so or not, the material proofs of Westminster, Hackney, Bethnal Green, and Finsbury will require some wiping out on their part. By the inverted gas-lamp—high and low pressure types—economy on the part of gas has been hoisted up far too securely to be knocked over by platitudes and erroneous statements of contemporaries, or by letter-writing to the papers by secretaries and engineers of electricity supply undertakings. It is not only in London but elsewhere that gas is scoring through economy and efficiency. The extensive high-pressure lighting contract at the Brighton station is a case in point. Gas does not need to support its victories by falsehood. No one, to the best of our knowledge, has suggested that gas is being substituted for street lighting throughout the City of Westminster; but what is said is that gas has knocked electricity out of a choice centre piece of the city, has retained all the gas lighting, and has beaten electricity in the Victoria Street demonstration. We are also quite unprepared to say that gas would not have superseded electricity practically throughout Westminster at this time, had not that deplorable and senseless contract for electric lighting (which, tied as they now are for an unreasonable period, the authorities greatly rue) been entered into in its expiring hours by the St. George's Vestry. There is nothing to boast about in the contract being still in existence, to the great annual loss and detriment of ratepayers. Again, Mr. Edward Searle, the Secretary of the Charing Cross Electric Supply Company, cannot, by all his prolix "explanations" as to why electricity lost the Westminster lighting contract recently the subject of competitive tender, "explain" away the whole of the difference of what the lighting will cost for gas (£13,800) and what it would have cost by electricity (£21,800). Such a difference cannot be made away with by words. His own statement in "The Times" and other papers is a confession that the Electric Supply Companies did not enter into the competition on a basis to secure them the contract, but saddled the public

lighting with capital costs that they must have known would have put them out of court.

But as to the difference in annual costs, we have said it cannot be explained away by words. We apologize to the "Electrician." That sentient paper worked the whole thing out, and came to the conclusion that the Gas Company were only charging 5⅜d. per 1000 cubic feet for the gas that will be consumed in Westminster! We dealt with this absurd statement on a previous occasion; but the "Electrician" does not mind how silly it looks, and now repeats the assertion, and adds testimony to its foolishness and ignorance in this matter by referring to the 5⅜d. as being "about one-fifth of the Company's *standard* price." The "standard" is italicized in the original, which makes the ignorance doubly assured, because the standard price of the Gaslight and Coke Company is not represented by about five times 5⅜d. We will not waste space by dealing with the extraordinary absurdity again. But the "Electrician" has presumed to know all about this question from the beginning; so we will let it continue to live in the transient enjoyment of the stupid declaration, also of such dogmatism as is expressed in the statement that the contract was taken "at a wholly unremunerative price, purely for the sake of advertisement," and of the harmless little pettish gibe at the "ghastly mantles which, unfortunately, we shall soon see in Regent Street." Our contemporary will completely lose its head if it does not take things a little more calmly and (may we add without offence?) sensibly.

So far as we can judge from the information before us, the municipal electricity trading authorities who have not authority to indulge in business in electric wiring and fittings are not entering whole-heartedly into the question of the joint promotion of a Bill for the power that was snatched from their grasp when Parliament was lately engaged in emending and extending the General Electricity Supply Acts. They all want the power who have not yet got it; and some of those who have it already wish they had not. This is one of those cases in which the want of possession is looked upon by some authorities as a drawback; while the actual possession in the case of other authorities has been a deplorably costly matter. Parliament and the Local Government Board have seen this; and where wiring and fitting powers are now allowed to municipal traders, Parliament in its wisdom ordains that the business shall be conducted so that income shall be at least the equal of the expenses incurred, and in most cases it is also stipulated that the work shall be done through a contractor. This last stipulation is as gall and wormwood to many municipal electricity departments. It, however, is one of the penalties of wanting to enter into the business when local government has attracted to itself so many opposing elements in its conduct. Some members of local authorities are all for municipal trading, whether at a loss or not; many others (some local tradesmen) are for municipal trading so long as it does not come within the sacred provinces of the private traders. We have considerable sympathy for the latter, though they never deserved it in connection with gas supply. But between these opposing forces in municipal administration, the current question is whether or not there shall be support and participation in the promotion of the Joint Bill for wiring and fittings powers, with the result that some authorities are declining to have anything to do with the projected measure, and others are proposing to contribute a very mean sum apiece in furthering the scheme. Unless there are a very large number of authorities joining in the promotion, the sums that we have seen named will, we fear, prove altogether inadequate for carrying a contested Bill through Parliament—contested as this one will be tooth and nail by the Electrical Contractors' Association, the Ironmongers' Federated Association, and by large ratepayers such as gas companies. The last-named have no serious intention of sitting quietly while municipal authorities are contemplating further business (and of a kind that has proved so unremunerative in several places) that may call upon them for contribution to fill the shortages occasioned by its ill-luck. The large ratepayers are forced to look after themselves. When the private tradesmen's interests are being touched in the local administrative chamber, the municipal authority are at once as a house divided against itself; but when the interests of the private trading concern, distinguished by the title of the gas company, are in question, or are being attacked, then the cry is "no quarter." Well, well! it's no use brooding over the injustice inflicted by the modern development of municipal trading, which connotes development of municipal antagonism to private enterprise. It has come to a question of sharp fighting; and when there is an opportunity for defence, it must not be allowed to slip by.

If we mistake not, the Maidstone Corporation is one of those authorities who have been engaging in the wiring and fitting business without legal authority; and they are now hoping to get the removal of the disability and illegality, and things set right again, by the munificent (!) contribution of £25 to the expenses of the joint promotion. It has gone forth from the Liverpool Corporation and other well-known local authorities—in connection with the Standard Gas-Burner Bills—that it is a wicked, monstrous, and indefensible thing, and subversive of all local interests, that there should be joint promotions for parliamentary powers on the part of private interests; and we are wondering whether Maidstone and the other authorities who are joining in the promotion of the wiring and fittings Bill subscribe to the dictum in this matter of Liverpool and other prominent municipal bodies. If they do not, then it shows there is a distinct division of opinion among municipal authorities over the point that was raised as a side-issue to, and was designed to be the death-blow of, the Standard Burner Bills. But let that pass; it will be remembered at the proper time. Local authorities on this matter of joint promotions should, however, range themselves one side of the hedge or the other. We recommend the subject as a fit one for discussion at a meeting of the Municipal Corporations Association, with (say) the Town Clerk of Liverpool opening the debate on the side against joint promotion, and the Town Clerk of Maidstone leading off in favour. At the recent meeting of the Maidstone Town Council at which was discussed the recommendation of the Electricity Committee to take part in the effort to get wiring, hiring, and fittings powers, there was a good deal of inquiry as to why the Council should not have the powers just as the Gas Company have piping and fittings powers. There is a simple, and though simple yet a strong, reply to the interrogation. This is an extension of municipal speculation in a branch of business that has proved itself to be more speculative, taking the country through, than any business in which municipalities have hitherto been engaged. If the Gas Company speculate, they are doing so with their own money; if they lose, so much the worse for them and their business. If the Council speculate, they are doing it not with their own money, but with borrowed money; and if they cannot make good their obligations with respect to that money, then they have recourse to the simple expedient of wringing the deficits out of the ratepayers *nolens volens*. That is one difference that makes an important distinction between the Gas Company and the Electricity Department. Then Mr. Alderman Vaughan, the Chairman of the Electricity Committee, thinks it is right the department should be placed on the same footing as the Gas Company. Now Alderman Vaughan must know that, for the reason already stated, and others, the department can never be placed on the same footing as the Gas Company. Among the other reasons is this: That the scope for custom for electricity is relatively narrow. Loud are the complaints in the electrical papers of the inefficiency and expensiveness of all articles for household use for cooking, heating, and so forth; and there is a bowing of the knee to the inevitable, and a confession that the economy of gas for these purposes is, so far as can be seen at present, entirely beyond the reach of electricity. This limits the use in the domestic service of electricity to lighting; and there again the metallic filament lamp has made the outlay of capital a more precarious thing than aforetime when a larger revenue per service could be depended upon. The speculative element in the proposal has therefore increased by events, and has not diminished. There is another mistake that Alderman Vaughan makes. He seems to think that the introduction of electricity in the town has been a good thing for the ratepayers, and insinuates that, due to the introduction, there have been a couple of reductions in the price of gas during the period. As a matter of fact, the price of gas in the town is now 2s. 6d.; it has been 2s. 4d. And we have no hesitation in saying that had there been no electricity supply there, the Gas Company would have been supplying gas to-day at 2s.; and probably, with extended business, they would have been paying more than £1824 in the shape of rates. Certainly, the ratepayers would not have had to face any incapacity in times past of an electrical undertaking to pay its way, nor would there have been such high charges for public electric lighting as they have experienced. It would be interesting to hear Alderman Vaughan expatiate, in detail, upon the financial "advantage" that, during its seven or eight years' existence, the electricity concern has been to the town.

The recent Leicester decision has, of course, made this question of wiring and fitting powers more acute. There are many authorities who, like Leicester, have been engaging in this business without express powers, and have thus been acting *ultra vires*. Leicester's little plea that their authority in the matter of electricity generation, distribution, and sale included the business of wiring and supplying fittings, inasmuch as service must include the provision of means to use the commodity supplied, did not appeal to the Court. The local water authority might just as well say that its duty extends to the provision of cisterns, water-taps, baths, kettles, and so forth, as service must comprise use. If the plea had held good, the blessing of every municipal electricity authority in the United Kingdom would have been extended to Leicester, as there would have been no further occasion to go to Parliament, the trading local authorities could have snapped their fingers at the Electrical Contractors' and the Ironmongers' Associations, and there would have been no need for the promotion of the Joint Bill. But there is already talk in several places as to what can be done in view of the Leicester judgment, as an alternative to bringing contractors and their many supporters buzzing in a most uncomfortable manner about the heads of town councillors. The only alternative that can be discovered is to engage a number of canvassers for new installations and business extensions—no Act of Parliament is required for this; and then to pass on to the contractors the work gathered in. To this, the contractors could have no objection; but there are ratepayers, who, if the local authority financed the business, would desire to ensure that no loss would fall upon the community, and that the business would always be conducted on paying lines. It must, however, be admitted that it is not an economical way of doing the business to have so many engaged in it. But, on the other hand, municipal trading speculation has imposed so much hardship on innocent ratepayers that there must be greater control, and assurance that a limit is put to this sort of thing. It is absurd that people who have no lot or part in creating a trading deficit

should be called upon to help to make it good. However, the employment, at the expense of municipal electricity undertakings, of canvassers to procure business for the electrical contractors ought surely to keep these watchful dogs quiet, though there is always the danger of preferential treatment of certain contractors, which may upset the happy scheme, and create much envy and uncharitableness.

The repeated fires from short-circuits or wire fusings—fires that break out in most unsuspected places without the slightest warning, and rapidly involve persons and property in their relentless destructive progress—are causing consternation among the private and municipal owners of electricity undertakings and their customers; and many a shopkeeper who has adopted this capricious mode of lighting his establishment is asking, "Whose premises next?" There is an awesome feeling about it all for the users of electric current. The former confidence of the easily gullible public in the bold advertisements of the electricity generators and salesmen, as to electricity being the safest illuminant, is being rapidly undermined; and the public will soon be writing-down those who are responsible for such advertisements as the most unmitigated—never mind what—that they have ever met. But, in places, the conscience pricks. We saw recently that, at a meeting of the Burnley Town Council, a member called attention to the huge fire that claimed both life and property at Accrington. This member wanted to know several things—whether there was not some sort of safeguard that could be fixed to hanging wires—especially in shop windows where there was flimsy drapery; whether the Electricity Committee had any power to compel the use of such safeguards if they existed; or if they had no compulsory powers, whether they could do something in the way of moral suasion. Though the Mayor is the Chairman of the Electricity Committee, he could not say whether they had any power in the directions indicated; but the "moral suasion" idea rather appealed to him as a good one. The difficulty is that advertising safeguards, and using moral suasion, rather gives away the "safest illuminant" fraud.

MODERN COKING PRACTICE.

In previous issues of the "Journal," notice has been taken of the series of pamphlets on matters connected with the coal trade which are being published by the "Colliery Guardian." They are reprints, in a convenient form, of articles that have appeared in that paper; and the last issued contains one by Mr. Ernest Bury, M.Sc., F.C.S., on "The Tendencies of Modern Coking Practice."

The subject is certainly one on which the author is specially qualified to speak; he having, as readers may remember, read a paper on "The Carbonization of Coal, with Special Reference to the Bye-Product Coking Process," before the Institution of Gas Engineers three years ago. In the article now under notice, he cannot, of course, go very fully into the subject; but in the space at his disposal he has brought together some interesting particulars. He opens with a few remarks on the conservation of our coal supplies, and then refers to the attempts which have been made of late years to produce a low temperature coke—coalite, for example—which would be readily combustible in a household grate, and at the same time effect the recovery of the gas and bye-products. He thinks that this is a mistake, and considers the aim should be to seek new methods for the ready combustion in household grates, boiler furnaces, &c., of coke, however hard, made by high-temperature carbonization; and he suggests that this is the true solution of the smokeless firing problem.

Turning to the subject of coke-oven gas as an illuminant, Mr. Bury remarks that, with few exceptions, managers of these plants have been apathetic in regard to the production of a gas suitable for town use in conjunction with the manufacture of a good coke. He points out, however, that the conditions under which gas may now be supplied have undergone a revolution. We have arrived at a time when the calorific value of gas is of the first moment; and as a consequence "the fetish of candle power is going to the wall." This change has opened up possibilities for the utilization for gas-making purposes of coal which would otherwise go to the spoil heap, and the gas from sister carbonization processes need no longer be considered only fit for boiler fuel, but can come within the scope of town's requirements.

On the subject of the design of carbonizing plant, Mr. Bury states that up to the last few years, inventors of coke-ovens principally confined their attention to the construction of the heating flues and to the methods of preheating the air necessary for the combustion of the gas within them; and but little attempt was made on the large scale to simplify the treatment of the gas and the recovery of the bye-products. The plant was both bulky and complicated; and the method of operating it wasteful from a thermal standpoint. He refers to the efforts at improvement made by Brunck in 1903, and to the sulphate-recovery processes of Otto-Hilgenstock and Koppers—illustrating his remarks by diagrams of these systems. Comparing the three processes, he shows that with the old process, where the whole of the liquor is condensed and reheated, 8 tons of steam were required per ton of sulphate made, whereas in the Koppers process, where only the liquor from the condensers is reheated, the quantity is 5 tons, and in the Otto process, where no condensers are employed, it is 1 ton only, and in some cases *nil*. Mr. Bury says the new Otto process, though only about a year old, is making rapid headway in Westphalia.

The article closes with a reference to the efforts of Burkheiser to effect economy in the manufacture of sulphate of ammonia simultaneously with the purification of gas from sulphuretted hydrogen. This invention, which has been fully described in the "Journal" [see Vol. CVIII., pp. 311, 326, 477], aims at the utilization of the volatile sulphur in the coal for the production of an acid; thus obviating the need of purchasing sulphuric acid for sulphate manufacture. Mr. Bury thinks that the treatment of coal or coke-oven gas for the recovery of tar and sulphate would reach its zenith by a combination of the simplified Otto system with another such as that of Burkheiser.

COAL PRODUCTION OF THE WORLD.

Quantity Used for Gas-Making in the United Kingdom.

For some time past, we have been looking in vain for a fresh issue of the "Coal Tables" which it has been customary to print annually as a parliamentary paper, as those dealing with the year 1907 were noticed in the "Journal" as long ago as March of last year. Now, however, the Board of Trade have rewarded an expectant public by the issue (over the signature of Mr. G. R. Askwith) of tables covering (in some instances) the period 1908-9, and giving, as usual, particulars of the production, consumption, and imports and exports of coal in the British Empire and principal foreign countries, together with statements showing the production of lignite and petroleum in the principal producing countries. There are more than twenty tables dealing with ordinary coal, and four more which have reference to lignite and petroleum; and the figures, in addition to detailing production and consumption, furnish much information with regard to prices, the number of persons employed, &c. Quantities are expressed throughout in terms of the English ton of 2240 lbs.; but it has to be borne in mind that most of the figures for 1909 (as well as some of those for 1908) are provisional, and therefore subject to correction, though no doubt they may be accepted as being sufficiently accurate for practical purposes. As was the case with the tables last noticed, there are included on the present occasion particulars with regard to the quantities of coal used in gas manufacture and in the production of pig iron in the United Kingdom.

The total known coal production of the world in 1908 (exclusive of brown coal or lignite) was about 950,000,000 tons, of which the United Kingdom was responsible for more than one-fourth. For the previous year, the figure was given as 1,000,000,000 tons; and for 1906, as 905,000,000 tons. The five principal coal-producing countries are the United States, the United Kingdom, Germany, France, and Belgium. In Germany and in France the production of coal increased throughout the period covered by the present tables, and was in 1909 greater than in any previous year. In the United Kingdom, Belgium, and the United States, the production in 1909, though greater than in 1908, fell short of the year 1907. The excess of the output of 1909 over that of 1908 was small in all cases except the United States. The aggregate output in 1909 of the five countries named was 860,000,000 tons, or an increase of 23,000,000 tons on 1908, but less by 36,000,000 tons than the output of 1907. The figures for the past three years are as follows: United Kingdom—1907, 267,831,000 tons; 1908, 261,529,000 tons; 1909, 263,774,000 tons. Germany—1907, 140,885,000 tons; 1908, 145,298,000 tons; 1909, 146,507,000 tons. France—1907, 35,411,000 tons; 1908, 36,044,000 tons; 1909, 36,654,000 tons. Belgium—1907, 23,324,000 tons; 1908, 23,179,000 tons; 1909, 23,182,000 tons. United States—1907, 428,896,000 tons; 1908, 371,288,000 tons; 1909, 390,336,000 tons. Of the remaining countries included in the tables, Russia alone has a production exceeding 20,000,000 tons. Though last year the output of the United States was about half as much again as that of the United Kingdom, the United Kingdom is still ahead when the production of coal is compared with the population; the output amounting to 6 tons per head, as against the 4½ tons of the United States. The figure for Belgium is 3⅛ tons, Germany about 2¼ tons, and France less than 1 ton per head. With regard to the number of persons employed in the coal-mining industry, also, the United Kingdom is a long way in front of any other country. In 1908, the number of persons employed in coal mining above and below ground in the several principal producing countries was as follows: United Kingdom, 966,300; United States, 690,400; Germany, 591,000; France, 191,100; and Belgium, 145,300. In drawing any conclusions from the comparison of these figures with one another and with the output of the several countries, however, the report points out that it must be borne in mind that they include varying proportions of persons engaged in the actual work of getting coal and in other work connected with the mines, and that the regularity of employment of those included in the totals of employed is not the same in all countries. In the matter of the output per person employed, the United States in 1908 took the first place with 541 tons, then came the United Kingdom with 271 tons, afterwards Germany with 246 tons, France with 189 tons, and Belgium with 160 tons.

In 1907, the largely increased output was accompanied by an increase in the price of coal in all the five largest producing countries. In Germany, France, and the United States, the

average value per ton of coal at the pit's mouth was greater in 1908 (which is again the latest year for which the figures are available) than in 1907; while in the United Kingdom and Belgium the value was less. In Belgium the average value per ton at the pit's mouth was 7d. lower in 1908 than in 1907; while in the United Kingdom the average reduction was 1d. only. In Germany the average value per ton at the mines was higher than in 1907 by 6¾d. per ton, in France by 8¾d. per ton, and in the United States by ¼d. per ton. Of course, when comparing the figures for different countries, or for different years in the same country, it has to be remembered that the average values shown are not for coal of the same quality. Thus the figures for the United States are affected by the variations of the proportions of anthracite and bituminous coal in the total output, as well as by the changes in the value of each variety of coal. The average values, too, are influenced, not only by differences of quality, but by differences in the accessibility of the seams, in methods of operation, in the cost of labour, &c. The values per ton at the collieries for the five leading countries for the three latest years for which statistics are yet available are given as follows: United Kingdom—1906, 7s. 3½d.; 1907, 9s.; 1908, 8s. 11d. Germany—1906, 8s. 11d.; 1907, 9s. 8¾d.; 1908, 10s. 3½d. France—1906, 11s. 2½d.; 1907, 12s. 3d.; 1908, 12s. 11⅞d. Belgium—1906, 12s. 2½d.; 1907, 13s. 8½d.; 1908, 13s. 1½d. United States—1906, 5s. 9½d.; 1907, 5s. 11½d.; 1908, 5s. 11¾d.

The outputs of coal in the principal parts of the British Empire are, of course, not in any case on a very large scale—in only two instances do they exceed 10,000,000 tons. But all the figures, it will be seen, exhibit an increase for 1908 when compared with the preceding year. The production in British India was 12,770,000 tons in 1908, and 11,147,000 tons in 1907; in the Commonwealth of Australia, 10,194,000 tons in 1908, and 9,681,000 tons in 1907; in New Zealand, 1,861,000 tons in 1908, and 1,831,000 tons in 1907; in Canada, 9,720,000 tons in 1908, and 9,385,000 tons in 1907; and in the self-governing Colonies of South Africa, 4,938,000 tons in 1908, and 4,679,000 tons in 1907. In Australia the output during 1908 amounted to about 2⅜ tons per head of the population, in New Zealand to rather less than 2 tons, in Canada to nearly 1½ tons, and in the self-governing Colonies of South Africa to about ⅘ ton. The average value per ton at the pit's mouth of the coal produced in the different parts of the Empire varies greatly, as will be perceived from the following figures: British India—1906, 3s. 11d.; 1907, 4s. 8d.; 1908, 5s. 3d. Commonwealth of Australia—1906, 6s. 3d.; 1907, 6s. 10d.; 1908, 7s. 4½d. New Zealand—1906, 10s. 7d.; 1907, 10s. 7d.; 1908, 10s. 4½d. Canada—1906, 9s. 4d.; 1907, 10s. 8½d.; 1908, 10s. 8d. Self-governing Colonies of South Africa—1906, 7s. 5½d.; 1907, 7s. 4½d.; 1908, 7s. 2d. Thus in British India, South Africa, and Australia the average value of coal produced was lower, and in New Zealand and Canada higher, in 1908 than in this country. Values in 1908 were higher than in 1907 in India by 7d. per ton, and in Australia by 6½d. per ton. In South Africa and New Zealand the value was lower by 2½d. per ton.

The foreign countries which export coal in excess of the amount they import are Germany, the United States, Japan, and Belgium; and of the divisions of the British Empire included in the tables, the United Kingdom, the Commonwealth of Australia, the group of self-governing Colonies in South Africa, and British India are in the same category. The excess of exports over imports in the years 1908 and 1909 in these cases was as follows: United Kingdom—1908, 85,301,000 tons; 1909, 86,029,000 tons. Germany—1908, 15,453,000 tons; 1909, 16,769,000 tons. United States—1908, 10,353,000 tons; 1909, 11,277,000 tons. Japan—1908, 2,832,000 tons; 1909, 2,729,000 tons. Belgium—1908, 664,000 tons; 1909, 727,000 tons. Commonwealth of Australia—1908, 4,091,000 tons; 1909, figures not yet available. Self-governing Colonies of South Africa—1908, 804,000 tons; 1909, 1,003,000 tons. British India—1908, 98,000 tons; 1909, 304,000 tons. Both the gross and net exports of the United Kingdom and of Germany in 1909 were the greatest recorded. In the United States, while the gross exports were somewhat smaller than in 1907, the net exports were greater than in any previous year. The total quantity of coal exported (excluding coke, patent fuel, and bunker coal) from the United Kingdom during 1909 was 63,077,000 tons, as compared with 62,547,000 tons in 1908, and 63,601,000 tons in 1907. The comparative steadiness shown by the figures for these three years, it is remarked in the report, is in striking contrast with the large increases in the years immediately preceding them. The exports of German coal in 1909 were greater than in 1908 by about 2,000,000 tons.

The imports of coal into the United Kingdom (always a negligible quantity) amounted in 1909 to only 8000 tons. The foremost place in this respect is, as usual, taken by Germany, whose imports were in 1908 12,589,000 tons, and in 1909 13,294,000 tons, about two-thirds of which was obtained from the United Kingdom. In fact, the imports of British coal into Germany during the past three years have been on a scale more than twice as large as ten years earlier. The principal coal-producing foreign countries which in 1908 and 1909 imported coal in excess of the amount they exported were Russia (excess amount of coal imported in 1908, 4,453,000 tons), Sweden (1909, 4,426,000 tons), France (1909, 17,673,000 tons), Spain (1909, 2,423,000 tons), Italy (1909, 9,064,000 tons), and Austria-Hungary (1909, 10,460,000 tons); while of the divisions of the British Empire, Canada (1909, 7,449,000 tons) and New Zealand (1908, 187,000 tons) occupy the same position. The gross imports into all these countries for which last year's figures are available were somewhat greater in 1909 than in 1908. With regard to all these figures, a complication is, however, introduced by the fact that the published returns of exports from the different countries do not in every case show the procedure adopted in connection with bunker coal, which is included in some instances, but not in others.

The consumption of coal in each country is arrived at for the purposes of the tables by adding the imports to the home production, and deducting the exports. The total consumption of coal in the United States is more than twice as great as that in any other country, and, in fact, is nearly equal to the combined consumption of the United Kingdom, Germany, France, and Belgium. In the matter of consumption per head, the United States also occupies first place, although the United Kingdom is not so very far behind. The consumption *per capita* in most of the other countries seems very small. But in this connection the use of other fuels than coal, particularly in France and Germany, must be taken into account. The largest coal-consuming countries in 1908 and 1909 were: United States—1908, 360,935,000 tons; 1909, 379,059,000 tons. United Kingdom—1908, 176,228,000 tons; 1909, 177,745,000 tons. Germany—1908, 129,845,000 tons; 1909, 129,738,000 tons. France—1908, 52,995,000 tons; and 1909, 54,327,000 tons. The consumption of coal per head of the population in some of the principal countries in the year 1908 was: United States, 4·14 tons; United Kingdom, 3·96 tons; Belgium, 3·11 tons; Germany, 2·05 tons; France, 1·35 tons; Austria-Hungary, 0·51 ton; and Russia, 0·19 ton. As to the Colonies, the consumption of coal per head of the population is greatest in Canada, with 2·46 tons. In the United Kingdom in 1909, 100 per cent. of the coal consumed was of native production; and in the United States 99·67 per cent. In Germany, 89·75 per cent. was native, 8·04 per cent. was British, 2·21 per cent. came from other countries. In France, 64·57 per cent. was native, 17·23 per cent. was British, and 18·2 per cent. was from other countries. In Belgium, 71·37 per cent. was native, 7·53 per cent. British, and 21·1 per cent. from other countries. The quantity of British coal imported into Germany for consumption in 1909 amounted to 10,400,000 tons. The average quantity of British coal consumed in Germany in the five years 1905-1909 was 9,430,000 tons; while during the five years 1900-1904 it was only 5,485,000 tons. In the case of France the imports of British coal last year amounted to 9,362,000 tons.

In 1908, the production of lignite in Germany was 66,529,000 tons, in Austria 26,299,000 tons, and in Hungary 7,037,000 tons. The provisional figures for 1909 show a production of 67,432,000 tons for Germany, and 25,503,000 tons for Austria. The quantity of lignite produced in the United States is included in the figures of coal produced. In no other country does the output reach 1,000,000 tons a year. With regard to petroleum, the total production of the United States in 1908 was 6,282,000,000 gallons, compared with 5,811,000,000 gallons in 1907, or an increase of 8 per cent. The Baku and Groznyi oilfields of Russia yielded 2,176,000,000 gallons in 1908, which, though larger than the output in 1905, 1906, or 1907, was still considerably less than in 1903, when it reached 2,955,000,000 gallons. The combined output of petroleum in Germany, Austria, Roumania, Japan, Canada, British India, and Dutch East Indies in 1908 was, according to the present statistics, 1,339,000,000 gallons.

Below is the statement given of the total quantity of coal carbonized by gas undertakings in the United Kingdom in each year from 1904 to 1908 inclusive.

COAL USED BY GAS UNDERTAKINGS IN THE UNITED KINGDOM.

—	1904.	1905.	1906.	1907.	1908.
	Tons.	Tons.	Tons.	Tons.	Tons.
Companies . . .	8,673,343	8,722,145	8,922,781	9,240,280	9,281,738
Local authorities*.	5,622,259	5,758,180	5,923,476	6,166,473	6,112,569
Total. . .	14,295,602	14,480,325	14,846,257	15,406,753	15,394,307

* Twelve months ended March of the years following those stated.

The "Pitometer" as a Leak Detector.—Underground leaks discovered and stopped by the "Pitometer" division of the Water Department at Washington, for the financial year ended June 30, are said to have saved more than 6 million gallons of water per day, or one-tenth of the total daily consumption. Most of this waste, or an average of 5 million gallons daily, was due to defective service-pipes leading into residences and business houses. The instrument named was described and illustrated in the "JOURNAL" for Jan. 28, 1908 (p. 238).

Commercial Rust-Proofing.—According to some particulars in "Iron Age," the Bradley process of rust-proofing is a hydrogen gas treatment. The article to be rust-proofed is placed in a muffle, where it comes in contact with hydrogen gas and other materials necessary to the process, and is then subjected to heat. This changes the surface, forming an alloy which resists the action of oxygen in air or water. The process can be used on bolts, nuts, or other threaded articles, as it does not cause any interference with the threads, as plating does. In addition to the rust-proofing, the treated articles are benefited by the careful cooling, which anneals them. The process cannot be used on hardened or tempered pieces. The colour obtained is a dark, rich, blue-black, well adapted for highly-finished articles.

WAGES AND HOURS OF LABOUR IN 1909.

As an index to trade conditions, the statistics of the Labour Department of the Board of Trade dealing with changes in rates of wages and hours of labour are worth consideration.

The seventeenth annual report (over the signature of Mr. G. R. Askwith) was issued some days ago; and it sets forth the changes, during the year 1909, in the rates of wages and recognized hours of labour of workpeople in the United Kingdom for a full week's work, exclusive of overtime. A "change in wages," it may be pointed out, is defined, for the purposes of the report, as a change in the weekly or hourly rate of remuneration of a certain class of workpeople, apart from any change in the nature of the work performed. Notice is not taken of changes in average earnings arising out of variations in the extent of employment obtainable by workpeople. The value of statistics prepared on the basis indicated is emphasized by Mr. Askwith in the remark that "in this country, where the system of collective agreements between organizations of employers and workpeople has become more general than in any other, the recorded changes are so important and so definite as to yield an excellent indication of the rise and fall in the market rate for labour." In view of the fact that changes in rates of wages are intimately connected with the demand for labour, and as there are periods of improving and of declining employment so also there are periods of rising and of falling wages, the necessity is impressed upon students of the report of not, when considering the course of wages, selecting arbitrarily a few years, but of looking at the whole cycle, so as to include both the good and the bad years. Regarding the matter in this light, it is seen that since 1896 there have been two periods of rising wages (1896-1900 and 1906-7), and two periods of falling wages (1901-5 and 1908-9). Thus, last year—or, at any rate, the first three-quarters of it—as well as the twelve months preceding, was an unfavourable time for workpeople; but it is gratifying to note that the preliminary figures for the first half of 1910, which are now available, indicate that the fall in wages has been arrested, and that "the market rate for labour is beginning to feel the usual effect of improving trade and employment." However, in spite of the considerable amount of the total reductions taking effect in 1908 and 1909, the general level of wages at the end of the latter year was, with the exception of four occasions, higher than at the end of any year since 1893, when the statistics of changes in wages were first systematically collected.

The number of workpeople reported to the department as affected by changes in rates of wages during the year 1909 was 1,154,800 (exclusive of agricultural labourers, seamen, and railway servants). Of these, 18,400 received increases amounting to £1000 per week, and 1,131,500 sustained decreases amounting to £69,900 per week; while the remaining 4900 workpeople had upward and downward changes which left their wages at the same level at the end as at the beginning of the year. Thus the net result of all the changes was a decrease of £68,900 per week. This compares with a net decrease of £59,200 per week in 1908. The report states that, if the effect of the changes in rates of wages be calculated from the date of each change to the end of the year, the aggregate decrease in wages due to these changes is computed at £2,757,400 in 1909, as compared with a decrease of £873,800 in 1908, and increases of £5,821,000 and £1,419,000 in 1907 and 1906 respectively. Of the 1,131,500 workpeople who were unfortunate enough to have their wages reduced last year, 870,000, or nearly 77 per cent. of the total, were employed in coal mining; other sufferers being persons working in iron mining, pig iron and steel manufacture, engineering and shipbuilding, and the building and cotton trades. The relatively small number (18,400) of workpeople whose wages were increased included 3500 in the building trades, 2000 engaged in the manufacture of pig iron, and 4000 in the employment of public authorities.

Though the past two years were, as already shown, periods of falling wages, the net result in the changes of the last fourteen years proves that at the end of 1909 wages were nearly £339,500 per week higher than at the end of 1895; while at the end of 1908 they were £408,400 higher. At the end of the year 1907 they were £467,000 per week higher, and in 1906 £267,000 higher, than at the end of 1895. In fact, the changes in the fourteen years from 1896 to 1909 resulted in a net increase of wages in each group of trades, except quarrying, which exhibits a very trifling decrease. Of the total gain in this period of £339,500, no less a sum than £162,500 appears to the credit of coal mining; while the engineering and shipbuilding trades come high up in the list with a gain of £33,000.

The proportion of the industrial population (11·9 per cent.) affected by ascertained changes in rates of wages in 1909, was as usual largest in the coal-mining industry; the figure on this occasion being 89·5 per cent. Miners in every coalfield, with the exception of the Forest of Dean, had their wages reduced; the net amount of the decrease being over £56,000 per week, for the 870,000 persons affected. During the past thirteen years there have been both rises and falls; but the aggregate amount of the increases largely exceeds that of the decreases. In all districts wages stood at a higher level at the end of 1909 than at the end of 1896.

In the iron mining branch 9500 workpeople had their wages changed, the net result being a very small decrease; while in the quarrying industry 3100 persons received a trifling net increase. The result of all the changes in the rates of wages in the metal, engineering, and shipbuilding trades was a decrease of £4325 per week, affecting 93,484 workpeople, compared with one of £13,913 per week, affecting 175,908 persons, in 1908. Employment in the engineering and shipbuilding trades in the first half of 1909, says the report, was worse than in the corresponding period of 1908; but from the end of July onwards, the position steadily improved, and, though employment in these industries was still slack, the percentage of Trade Union members unemployed at the end of 1909 was lower than at the close of the previous year. The mean percentage of Trade Unionists unemployed in the engineering industry in 1909 was 11·6; and in the shipbuilding industry, 22·1. The corresponding figures for 1908 were 10·3 per cent. and 23·2 per cent. respectively. The changes in rates of wages in the textile trades in 1909 affected 156,200 workers. Of these, 1762 received advances amounting to £93 per week, and 154,438 sustained a decrease of £8113 per week. In the trades other than cotton, employment was reported to be fair or fairly good.

As already remarked, there were a number of cases of advances to employees of local authorities. These include increases of 9d. and 1s. 3d. per week to the coke-handling men at the Brighouse Corporation Gas-Works, making the wages 28s. 3d. and 29s. 4d. per week; while the labourers also received an advance of from 1s. to 24s. per week. In the Leeds Water Department, turncocks secured a rise of 1s. a week, to 29s.; and ferrulers and pipe-layers one of 2d. per day, to 5s., 5s. 4d., and 5s. 10d. Gas and water works carters at Bolton were paid from 3d. to 1s. more weekly, making a wage of 25s.; and Mansfield lamplighters benefited to the extent of 2s., which brought a week's pay up to 24s. and 26s. Seemingly the report does not contain any record of increases in wages paid to men in the employ of gas companies having taken place within the period now under review.

As to the methods by which changes in wages were arranged last year, 3·3 per cent. were under sliding-scales, against 6·5 per cent. in 1908; 68·2 per cent. were by conciliation boards, mediation, arbitration, &c., against 62·4 per cent. in 1908; and 28·5 per cent. were by other methods (direct arrangement, negotiation, &c.), against 31·1 per cent. in 1908. The diminution shown in the last seven years in the number of persons whose wages were regulated by sliding-scales is, it is pointed out, almost entirely accounted for by the alteration in the method of arranging the changes in rates of wages of the South Wales coal-miners. The increase in the numbers included under conciliation, arbitration, &c., in the last three years, was mainly due to the fact that coal-miners in the Federated Districts (Lancashire, Yorkshire, the Midlands, North Wales, &c.) had changes in wages in those years. The number of workpeople whose lessening of wages was preceded by a stoppage of work (153,865, or 13·3 per cent.) was considerably larger in 1909 than in any of the previous nine years. But this was accounted for by a dispute in the cotton trade. In this calculation, it should be noted, no account is taken of strikes or lock-outs that failed to produce some change in wages, or of threatened strikes and lock-outs that may have influenced the changes in wages made.

Consequent on the operation of the Coal Mines Regulation Act of 1908, the number of workpeople whose hours of labour were changed during the past year was considerably in excess of the number affected in previous years. The changes reported (which do not include temporary alterations in working hours owing to fluctuations in the state of trade) affected 562,891 workpeople, of whom 3212 had their aggregate working hours increased by 6399 hours per week, and 559,679 had reductions amounting to 2,398,721 hours per week. The net effect of all the changes was thus a reduction of 2,392,322 hours in the weekly working time of the people affected. It is estimated that 500,000 under ground workers in the coal-mining industry had their hours reduced by an aggregate of 2,290,000 per week as the result of the 1908 Act. Going back ten years, it is seen that every year there has been a net reduction in the working hours per week of the people affected by such changes. With regard to gas workers in the employ of local authorities, it may be remarked that during 1909 the stokers at Leek, Mansfield, and Sutton-in-Ashfield had their working time reduced to eight hours per day—equivalent to a reduction of 28 hours per week. At Leeds, the labourers in the Water Department had their time reduced to 50 hours per week.

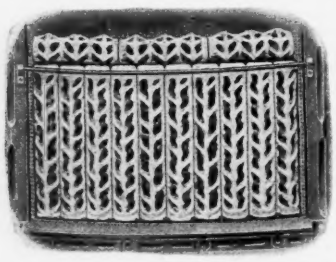
Standard Portland Cement.—The Engineering Standards Committee have prepared a revised British standard specification for portland cement, and it has just been published. Since the issue of the first revision of the specification, the Committee have continued their investigations into the question of the determination of the initial setting-time of cement. It was found that while the final setting-times determined by the British Standard and Vicat needles approximated very closely, the initial setting-time as determined by the former differed considerably from that given by the latter, and also from that obtained by the rough-and-ready test of the finger-nail. It was considered preferable that one instrument should be specified for determining initial and final setting-times; and the Vicat needle has been adopted. The Committee further recommend that no expansion test of the plunging type should be inserted in the standard specification. A minimum lime content, and the total loss on ignition are now specified, and provision is made for limiting the total amount of sulphur present, whether as sulphides or sulphates. The instructions for gauging cement have also been modified. The foregoing are the principal points where the specification differs from its predecessor.

THE FORWARD MOVEMENT IN GAS HEATING.

ANYONE whose experience covers the last half-dozen years (or even less) of the gas-heating industry must be struck—not once, but ever and again—by the vast change that has come over the spirit of—— we dare not complete the tag and say "its dream," for no word could be more inappropriate. Dreaming suggests, at least, lethargy, if not always sleep; but the gas-stove trade has become broad awake, and grows more preternaturally wakeful every day. In the old days that seem already so very old, though they were really only the day before yesterday, the gas-fire of one season was the gas-fire of the next. A new design or two might come out; but these only differed from their predecessors in some pattern of ornament. Year in year out the working part was on the old lines; and so gas-heating languished, and, instead of progressing, merely marked time. These last few years all this is changed. Improvement after improvement, development after development, succeed each other with a rapidity that would take away the breath of the good people of the older school. The limit reached in one season only marks the point of departure for the fresh advance of the next; and gas-heating has to-day a place in the public eye, and a hold on the public favour, which every friend of the industry must find as welcome as they are surprising, considering how very short has been the period in which this new movement has been brought about.

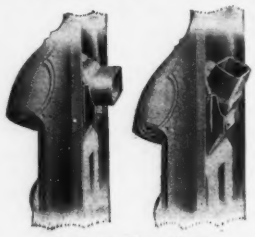
A movement so broad could hardly be traced to any one source exclusively; and Messrs. John Wright and Co. would doubtless be the first in generous and friendly recognition of the good work being done in the various other centres of gas-stove manufacture. Yet it would be difficult to exaggerate the degree in which the Essex Works have been identified throughout with this rapid forward movement in gas-heating. The association of science with practice, the laboratory with the pattern shop, in the gas-stove industry, speaks much for the initiative and the example of the Birmingham firm; and no one can blame them for reminding the public, as they frequently do, of the splendid list of new inventions and new methods that stands to-day to their credit, and grows greater each season. No one who has had the opportunity, as we have had, of becoming acquainted with their programme for the coming winter, will complain of their having asked the industry to "wait and see" that programme before placing their orders; and we may be sure that no one who took the advice to wait will regret it when once he sees.

In the many-sided activities of the Essex Works, three particular features have been outstanding. First of all, is their early grasp of the supreme importance of radiation in gas-fires, and their persistent spade work in developing it and carrying it to the high point they have done. Next is their advocacy of standardization and interchangeability of parts. And, third, is their insistence on certain well-defined lines of progress in the science of water-heating by gas. These features are once more well to the front in their new winter budget; and where the last word might well have been thought to have been said in their results of a year ago, fresh advances are still the order of the day. Indeed, we do not hesitate to say that this new programme of Messrs. Wright and Co. is by far the biggest and most impressive we have ever had placed before us. The "Thermo," with its last year's success still fresh, already "pales its ineffectual fire" before the even greater radiance of the new "Thermo X," which we learn as far excels the "Thermo" as that invention surpassed the previous best. Not one but several new patents contribute to this result. The burner has been entirely reconstructed, so as to give properly proportioned aëration under varying pressures and consumptions—such as, it is claimed, removes a hitherto unsolved difficulty as regards meeting pressure fluctuations. The firebrick construction is also new; and the "radiants" (as these makers describe what used to be miscalled the "fuel") are constructed on novel lines "to promote perfect combustion and radiation."



"Thermo" Fire Front.

This new type of "radiant" has been evolved by Messrs. Wright and Co. after testing and rejecting many methods and many materials for years past. In combination with fire-clay, they have tried the rare earths and also various metals. The first give disappointing results; the latter—such as iron, whether as an admixture or as a framework—neutralize any improvement in appearance by rapidly disintegrating the fire-clay, through the inequality between the various rates of expansion and contraction, as well as oxidation troubles. The advance as regards the "radiants" is, therefore, concerned largely with their construction; and there is a new patent self-locking clip for keeping them in position. Every fire can now be connected up from either right or left without any adjustment whatever. The gas and air adjustment is new; and while quite concealed from view, it is within ready reach of a turnscrew.



Adjustable Flue Outlet.

Nothing has more largely hampered the growth of gas-fire heating than the difficulty met with as regards flues; and sundry bends and other contrivances have been devised to suit varying shapes and measurements of chimneys. Yet the difficulty has remained as serious as ever. An adjustable flue-outlet to the stove is the ideal remedy; and this season it is made real by Messrs. Wright and Co. The flue troubles, and not infrequently flue-elbows, too, are done away with; up-draught is facilitated; good combustion and ventilation are promoted; and gas authorities are every way relieved of a constant source of worry and expense. Had this been its makers' only contribution to gas-heating this year, they would have deserved well of the industry.

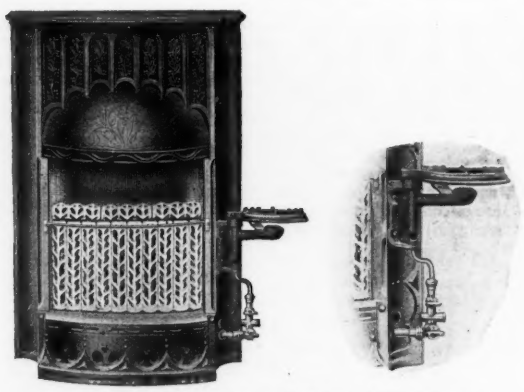
The wide-fire principle which was established some years ago by Messrs. Wright and Co., is this season applied on a much more general scale than before. Quite a number of their stoves are now offered with fires 17 inches and 21 inches wide; and this development is facilitated by a new duplex burner. This is utility. But with the addition of the new patent "Unitap," utility becomes luxury and beauty as well. No longer have two taps to be manipulated, and the eyesore of a Y-shaped gas-fitting tolerated. One quarter-turn at a time of the "Unitap" gives half fire, full fire, or none at all; and there is no piping in sight—nothing but the neat-looking tap itself.

So much for the gas-fire mechanism. There is at least as much that is new in gas-fire design itself. The "Wizard," "Mascot," and "Druid" (the trinity of interchangeables) have made such a mark on the record of gas-fire progress that one could scarcely have thought even the Essex Works itself could improve them. But improved they are, none the less—remodelled indeed; so that, while the distinctive lines of the originals are preserved, it is entirely new fires that are this year offered under the familiar, not to say famous, titles. The object of the metamorphosis has been to render these fires available for every conceivable kind of fireplace, and particularly to help the porcelain enameller to make them even more a thing of beauty than ever. A fourth star—the "Arch-Druid"—now adds itself to the constellation. Its object is to embody the makers' strong conviction that the conventional "Nursery" stove, with its boiling burner in the top, is open to grave objection on hygienic grounds. It harbours dirt and the overflowings of boiling food; but the new side boiling-trivet in its improved form is a happier and a healthier idea. Intermediate in cost between the "Wizard" type on the one hand and the most expensive class on the other, the "Stadium," so marked a success these two years past, is joined by the "Warlock"—a very handsome piece of apparatus, thermo-fronted, fitted with all the firm's

"Wizard" Fire.

"Mascot" Fire.

"Druid" Fire.



"Arch-Druid" Fire, with Trivet Arrangement.

newest refinements, and ornamented expressly with a view to porcelain-enamelling.

Yet another fire presents itself, of a design quite away from anything in Messrs. Wright's range of styles, or elsewhere. The "Armoric," which is only made in their armour-bright finish, is large, imposing, and artistic in the best sense. It should find a place in many an apartment where the owner's love for his antiquities and art treasures has hitherto made him look on even the best-designed gas-stove as somewhat incongruous.

"Stadium" Fire.

"Warlock" Fire.

Now we come to the "Autophyre," which is one of several *bonnes bouches* in a feast of good things. This is one of the inventions regarding which one wonders why they have not come before, so obvious seems the call for them, and so great (almost staggering) the possibilities opened up. And, indeed, this is not the first time the idea has been taken up. Several attempts to solve the difficulty have been made public; but the province remains virgin soil. Messrs. Wright and Co., determined to avoid any false starts, have "hastened slowly;" and after devising and testing for many months—extending almost to years—they have at length produced this patent contrivance by which every bedroom in every hotel and boarding-house in the country can have a gas-fire available to the visitor at any time on his placing the "nimble sixpence" in the convenient slot. It can be prepaid by one sixpence or a number, as desired; and every weak spot has been foreseen and assurance made doubly sure against the tamperer, whether he be dishonest or only stupid. No wonder the makers build high hopes on their patent "Autophyre." If only half their anticipations are realized, it should multiply the output of gas-fires (and of gas) by a very large factor indeed.

The "Autophyre."

The apostolate of the interchangeability doctrine carries its duties no less than its honours; and that Messrs. Wright have realized these duties is sufficiently shown by the length to which they continue to carry their principle. An object-lesson in this is the instance of four stoves which have every one of their parts in common except one—the front casting. Yet when we mention that these are the "Wizard," "Mascot," "Druid," and "Arch-Druid," it is superfluous to say how distinct each stove is, although all can be built from the one set of parts, with one single casting added to effect the change from "Wizard" to "Mascot" or from "Mascot" to "Druid." This interchangeability, however, began years before these stoves; and it is very far from ending with them, because not only these four, but every pattern of "Thermo" fronted fire is interchangeable in all its parts with corresponding parts of all the other patterns; while as regards the individual patterns, the careful machine-fitting which is universal throughout the Essex Works enables every part to be replaced from stock, with unerring accuracy of fit and without file or chisel. Such a state of things speaks volumes under the all-important heading of maintenance.

Patent "Garajo" Boiler.

From direct gas-heating to gas-heating by hot water is an easy transition; and once more an apparatus of great promise presents itself, in the patent "Garajo" boiler. It is light, yet it is not of copper, but of the cheaper and more durable cast-iron. It is small; yet it has no internal parts or interspaces, where deposit might gather. It has a fixed consumption of a surprisingly low figure; and it costs so little, burns so little, and is so entirely free from need of cleaning, and free from parts to replace, that for the owners of either large or small motor houses, greenhouses, and workrooms, and for many domestic and other uses as well, it promises to be so long a leap ahead as to warrant its makers in calling it the "Wizard" of gas water-heating. This is at once the highest praise and most sanguine prophecy; and the industry should hear great things of the "Garajo" before very long.

The "Ko-Ko" Stove.

This programme is so wide in its extent, and so forward in its reach, that its authors might well have been entitled to rest on their laurels within the sphere of gas-heating proper; but this year they break ground in yet another direction, in the hope of creating a new movement in the gas-coke side of the gas authorities' business, by designing a coke-stove of a degree of effectiveness, and a reasonableness of cost, such as has hitherto been quite wanting. The "Ko-Ko" is the name that has been given to this new apparatus.

M. Bonet's Curved Gasholder Tank.

The following remarks on this tank, which was described in the "JOURNAL" for the 5th ult. (p. 37), appear in the current number of "Engineering Record," in conjunction with some extracts taken, with due acknowledgment, from our translation of M. Bonet's paper at the Société Technique: "This gasholder tank is a marked departure from the form so commonly used in the United States. It illustrates the advantage of thorough analysis of stresses in steel construction; for if a great saving can be made in the thickness of the shell, it is only a question of time when this new design will compete with the older type. While the side plates in bulging tanks are of more irregular shape than those in cylindrical tanks, it is doubtful whether, after the construction becomes standardized, the cost of the bulging tank will be greater than that of the cylindrical form. Plates of from 1 to 2 inches in thickness, as required in some cylindrical tanks, are very difficult to shape and to rivet; and much of the work must be done in the field, where conditions are not conducive to efficiency. A tank which has plates of a maximum thickness of not more than (say) $\frac{3}{8}$ or $\frac{1}{2}$ inch can be more easily riveted; thus resulting in a saving of expense, even though the peculiar bulging form makes the side plates more difficult to cut. Water-tanks on towers are frequently built with hemispherical bottoms, notwithstanding the fact that the cost of cutting and bending the plates to conform to the spherical outline is more than would be the case if the bottom were flat. The advantages gained by connecting the supporting columns directly to the cylindrical sides and by eliminating practically all floor framing are great; so that tanks with spherical bottoms are often used in water-supply systems, in handling and storing ores, and for similar purposes."

PRODUCTION OF TARLESS FUEL.

Some time ago, a Syndicate was formed to work a process for the treatment of coal and other substances for the production of tarless fuel and the recovery of gas and residuals. A communication addressed to the Chairman of the Syndicate (Mr. O. J. Parker) brought the information that the process referred to is the subject of two patents taken out by Mr. W. Speirs Simpson—one being for the "purification and calcination of peat, brown coal, or lignite, and like substances," and the other for the "manufacture and purification of coke." The specification of the first patent has been published, and we give below an abstract of it. The application for the second patent was made on Sept. 3, 1909; but the specification is not yet ready. A meeting of the Syndicate was held a short time ago, at which the Chairman laid before the proprietors a statement on the progress made and on the general position of affairs; and the following particulars are taken from the reports which were published in the financial papers.

It appears that plant to work the process was completed at Battersea about the middle of July, and operations were commenced at once. There was no doubt about the success of the process in the treatment of coal; but, with the view of adding to the assets of the concern, the Directors turned their attention to the distillation of shale for the production of mineral oil and bye-products. They arranged for a supply of shale from Scotland and Australia, submitted both samples to a series of tests under the supervision of their Consulting Chemists, and obtained highly satisfactory results. With regard to the production of tarless fuel and coke, the Chairman stated that the trials were equally gratifying from a technical standpoint, and promised great results from the commercial side. The Directors began operations with the tarless fuel by fitting up a small experimental and development plant in the centre of the Derbyshire coal and iron district; and it proved all the principles claimed for the invention. But they saw that many improvements were required to enable them to get a full return from the process. These it was decided to proceed with, and it was arranged to fit up a complete installation at Battersea, where it could be under the constant supervision of the Directors. This decision has, it was stated, been justified to the fullest degree; and they are now turning out the finished product from coal in two hours, of a quality fit in every way to fulfil all the objects claimed for it, together with a yield of bye-products such as, for quantity and quality, was not considered obtainable a short time ago.

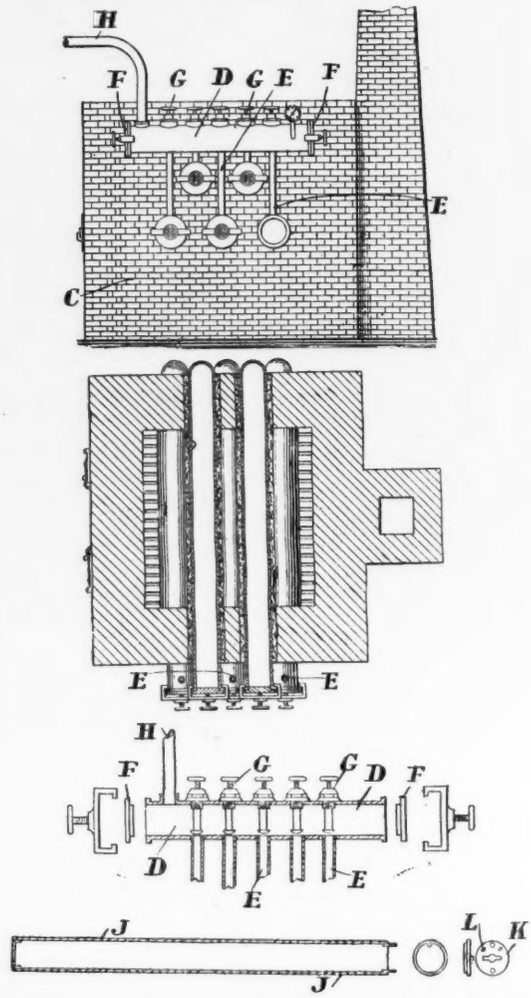
The success of the process on what might be regarded as the experimental scale having been assured, it was considered that the time had arrived for its development upon a commercial basis; and steps were taken to form a Company with this object. In dealing with this matter at the meeting referred to, Mr. Parker submitted the following estimate for working a plant to treat 750 tons of coal per day: Cost of coal, at 7s. 6d. per ton, £281 5s.; works expenses, at 3s. per ton, £112 10s.—total, £393 15s. This would, he said, produce 500 tons of tarless fuel at the works, to sell at 22s. 6d. per ton, amounting to £562 10s., and gas and bye-products at 10s. per ton, valued at £375—a total of £937 10s. Deducting the £393 15s., the result was £543 15s. per day. Reckoning 300 working days a year, a profit was shown of £163,125 per annum. He added that the Directors considered this a fair estimate; and it had been framed irrespective of the question of royalties and the other branch of manufacture to which attention had been given—viz., the distillation of shale for the production of oil. The Directors thought, however, they were justified in anticipating royalties, as it would be obvious to people interested in the production of coke that a process which would give a tarless coke in the short space of two hours was one that commanded very serious attention. To carry out work on the scale indicated, plant to treat 750 tons of coal daily would, it was stated, cost £100,000; but the Directors suggested that the first plant should be installed to deal with 150 tons. It was estimated that this would cost £20,000, and it would easily enable the Company to pay 10 per cent. on the whole capitalization (a nominal capital of £300,000 was proposed), extend the plant, or erect other plants in different localities, as required. Mr. Parker was asked whether, instead of producing three different qualities of coke, it would not pay better to carry the process to finality, and recover all the residuals. He replied that the difference in the time the coal was in the furnace was only a few minutes; and no doubt the Company and those who worked the process would ultimately settle down to produce whatever proved to be the most profitable variety of coke.

Abstract of Mr. Simpson's Specification.

The most important features of the process are: 1. The treatment of various substances or raw materials in such a manner that the amount of fixed carbon originally contained in them shall not be appreciably diminished during treatment. 2. The elimination of impurities from the substances treated and the conservation of such products of distillation as may be useful. 3. By means of the heat employed during treatment, the complete calcination of the substances treated and the final product or charcoal so produced being "rendered porous and of a highly absorptive character."

In carrying out the invention, the patentee proposes to enclose the substance to be treated in a metallic vessel or other retort or receptacle, preferably cylindrical in form, and so constructed that a vacuum is created and maintained inside the receptacle during a part or the whole of the time of the treatment of the substance. The retort is also provided with means for applying external heat at temperatures suited to the elimination of moisture and of certain gaseous and volatile products of distillation and finally to the application of the high heat necessary to the calcination of the carbonaceous substance under treatment. Means are provided for facilitating the passage of the heat through the substances placed in the retort, also for cooling (by water jacket or otherwise) such parts of the retort as may contain movable doors or covers, where the high heat employed might warp the parts, so as to admit air or impair the vacuum to be maintained.

The illustration shows the apparatus by which the process can be carried into effect—a front elevation of a furnace with five retorts (one being discharged) and a sectional plan.



Each retort consists of an outer fire-clay case lined with an iron inner tube closed at one end or open at both ends; the whole being set in brickwork so as to leave both ends of the iron tube protruding. D is a vacuum chamber and receiver, the details of which are shown. It is connected to each retort by pipes E; and its object is to collect any solid matter and bye-products that may come through with the gases. It is provided at each end with a door F for cleaning purposes. The stop-cocks G are also removable, so that in the event of any of the pipes being stopped they may be easily cleared. The pipe H is carried to an exhaust pump.

The lignite in the form of a powder is moistened with water until it is wet enough to bind together when pressed in the hands. It is then packed into sheet-iron cases J sufficient to fill three parts of their diameter. This, it is said, allows the gases to pass off more readily than if they were filled. The end of the case (fixed in position by studs and fly nuts) should have one or more vent holes L in such a position that, when the cover K is on, the vent holes are opposite the blank space. An eye should be fixed to this end to enable the case to be withdrawn from the retort. The case is slid into the retort; the retort connected to its pipe E; and the retort closed, and the vacuum cock opened. The calcining should take place at a good red heat. The object of enclosing the case J is that when calcining is complete, it may be withdrawn from the retort and allowed to cool before being removed from the case. The lignite is thus never exposed to the air while in a hot state.

These cases would, of course, be used in large numbers, so that as soon as one is withdrawn another would be immediately introduced—thus making the process continuous. That is to say, when the case J is to be removed, the valve of the case connecting the pipe will be closed, and the pipe disconnected. The valve G is then screwed down to close the end of the pipe; and the case J can be removed without destroying the vacuum in the chamber D, and a fresh case placed in position for a repeat.

By this invention, it is claimed that there is "produced pure fuel containing a high percentage of carbon and free from coal tar, and other objectionable impurities, and thus rendered peculiarly adaptable for the manufacture of producer gas."

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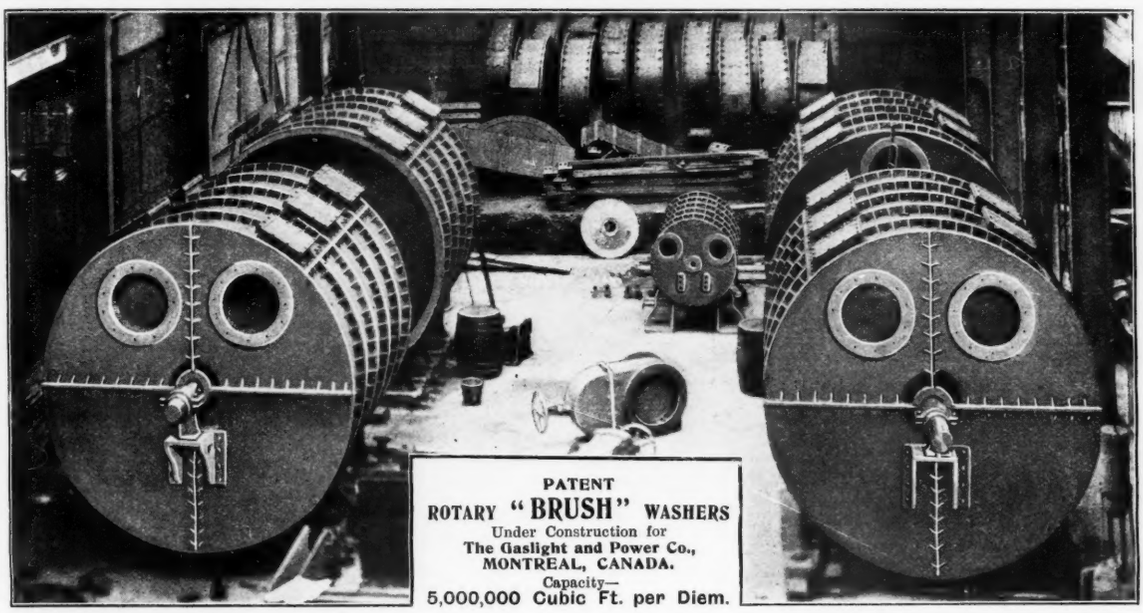

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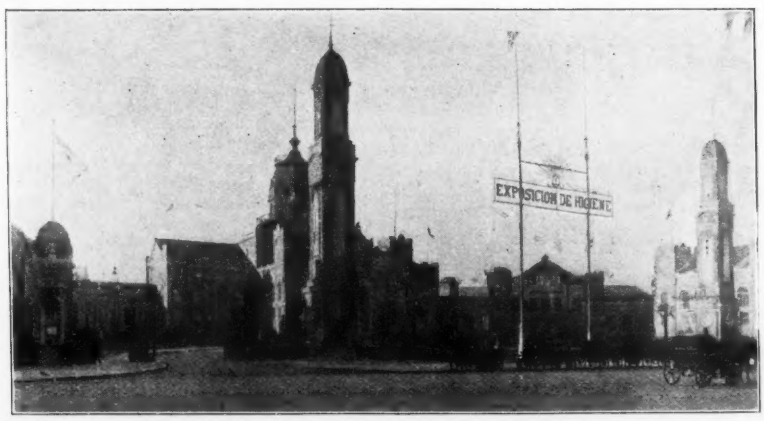
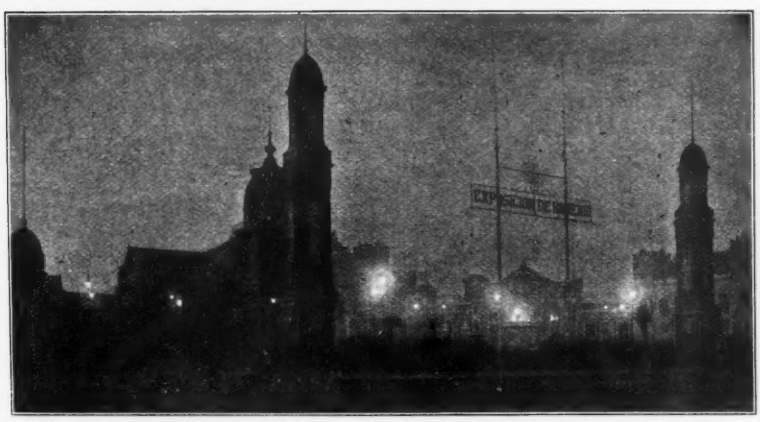
HIGH-PRESSURE GAS LIGHTING IN THE ARGENTINE CENTENARY INTERNATIONAL EXHIBITIONS.



Part Front View of the International Health Exhibition, Buenos Aires—Argentine Centenary, 1910.



A Similar View by Night—Showing the High-Pressure Gas Lighting by the Primitiva Company.

THE Argentine Republic is this year celebrating the centenary of its independence; and the Government decided to include in these celebrations a number of international exhibitions, of which the chief were to be Fine Arts, Railway and Transport, Health, Agriculture, and Industry, to be held in the city of Buenos Aires. These separate and independent exhibitions have now all been constructed and installed in special buildings (the majority of considerable elegance and magnitude), and opened to the public in less than twelve months from the time their construction was decided upon and the respective Executive Committees appointed by the Government to take charge of the projects. In the consequent rush and hurry, it was perhaps only natural that lighting questions, in the exhibitions which it was intended to open at night, should be shelved till the last moment. It therefore fell to the lot of the Primitiva Gas Company of Buenos Aires to be given just six weeks in which to order their material from Europe by cable, and carry out their installation of two complete high-pressure lighting systems for the grounds of the Health and Railway and Transport Exhibitions respectively. The following are some particulars of the work.

One of the Gardens (approaching completion) in the Interior of the Argentine Centenary Exhibition, and containing the Primitiva Gas Company's Bungalow.

Each plant aggregates 110,000-candle power, consisting chiefly of three-burner Graetzin improved inverted lamps of 1500-candle power, supplied with high-pressure gas at the customary 56 inches of water, erected at approximate distances of 25 metres (82 feet) from column to column. Each compressor is of the rotary type (without duplicate), belt-driven either by an electric motor or a gas-engine as desired. Each plant is installed in an underground-ventilated chamber having water-tight manholes. This particular mode of installation was adopted with the idea of showing the Buenos Aires Municipality the facility with which isolated installations can be made in avenues altogether remote from distributing centres.

Primitiva Gas Company's Bungalow at the Argentine Centenary Exhibition.

In the grounds of the Health Exhibition, the Primitiva Company also erected and fitted up a model gas bungalow similar to that shown last year by the Gaslight and Coke Company at the Imperial International Exhibition at Shepherd's Bush. This bungalow was erected, fitted, and furnished entirely in five weeks, in spite of difficulties encountered by the late arrival of material from England owing to congestion in the port of Buenos Aires, and the consequent necessity of making substitutes on the spot, at the last moment. In the principal restaurant of the exhibition, the Company are showing, under working conditions, a steam

tea, coffee, chocolate, milk, and egg boiler, also a steam cooker, all being connected to one of Still's boilers, which has been found to be entirely automatic as regards constant pressure, water feed, and controlled gas supply.

Referring to the accompanying illustrations, they comprise a partial front view of the Health Exhibition by day and the same by night, the Primitiva Company's bungalow in the Health Exhibition and the garden in which it is situated, still in an unfinished condition, but showing the type of lamp and column employed for the high-pressure lighting. It will be noticed that the garden patch in front of the bungalow is bounded by a dwarf wall constructed in retort-setting blocks (actually sight-hole frames and stoppers). It may be mentioned that the Primitiva Gas Company manufacture in Buenos Aires all their own fire-goods specials. The Company also showed in the Health Exhibition an extensive exhibit of chemical products, including their own make of sheep and cattle dips, disinfectants, and ammonia products. In connection with this, they installed complete working plant producing artificial ice, and automatic refrigerated chambers, employing pure anhydrous ammonia of their own manufacture.

Mr. Bernard F. Browne, formerly the Chief Engineer to the Company, who, as already announced in the "JOURNAL," has just returned to England, was responsible for carrying out all the exhibition work, employing exclusively local labour, which, it is interesting to note, was entirely Italian.

THE ALTERATION OF ORDINARY TO CONSTANT-LEVEL GAS-METERS.

In a short paper read before the Société Technique du Gaz en France at their recent annual meeting in Paris, M. Dupoy described a method of converting ordinary wet meters into those having a constant water-level. The author is associated with the Société Industrielle des Compteurs, of Paris, which is an amalgamation of firms of which he and MM. Maldant, Vanderpol, and Carnelli were the heads; and their "Duplex" meter, with injector, was awarded a silver medal by the Société Technique on the occasion of the meeting at Nancy in 1907.

Before describing his meter, the author remarked that, since the introduction of "Duplex" meters, those having ordinary drums had been gradually discarded in favour of others in which the water-level is kept constant. These had been adopted for new installations; but there were, of course, a large number of the old

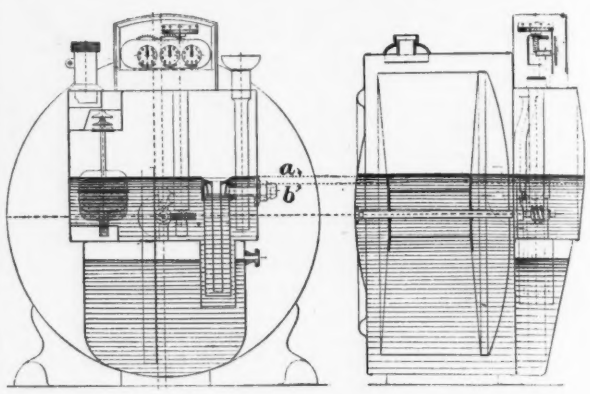


Fig. 1. Fig. 2.

kind in service which could not well be taken out, "scrapped," and replaced by others of the improved type. M. Dupoy pointed out, however, that when meters were from time to time removed for repair, it was possible to modernize them, and, as far as maintaining the water-level is concerned, bring them into a condition quite equal to the "Duplex" meters, by furnishing them with the compensating arrangement employed in the construction of

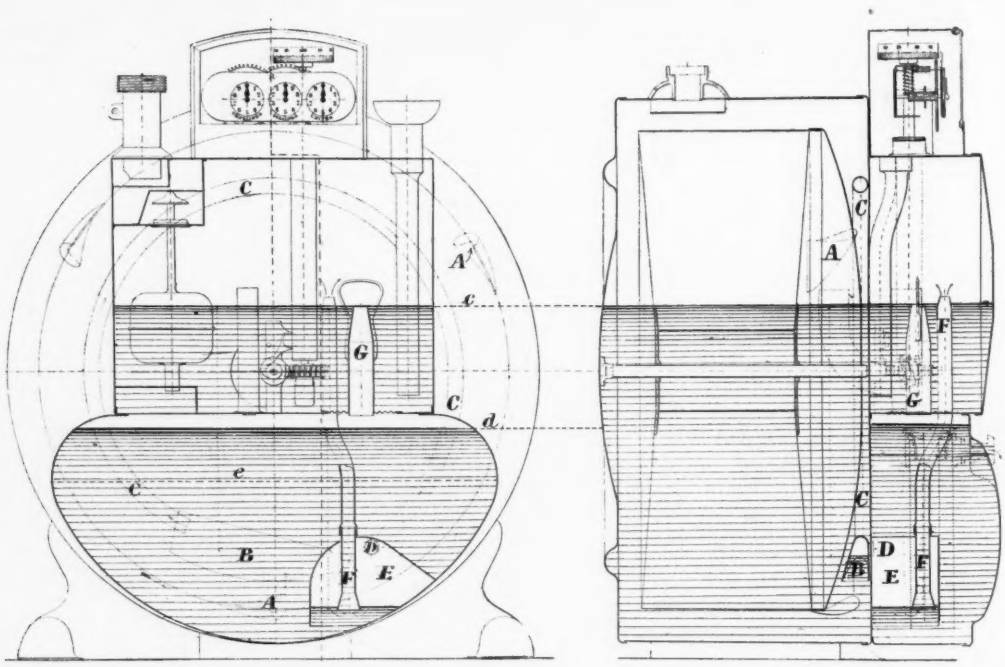


Fig. 3. Fig 4.

those meters, a description of which was given by him in a short communication made to the Société Technique at their meeting at Havre in 1905.

The method of transforming a meter is shown by the accompanying illustrations, in which figs. 1 and 2 represent a meter of the ordinary kind, and figs. 3 and 4 the same meter converted into one with constant water-level. In fig. 1, the normal water-level is shown at *a*, and the level lowered after evaporation at *b*. In fig. 3, the constant water-level is shown at *c*, the level of the water in the reservoir at *d*, and the lowered water-level at *e*. It will be noticed that the hydraulic box of the syphon in figs. 1 and 2 is dispensed with, and replaced by a water reservoir of large dimensions, as shown in figs. 3 and 4. The water-level regulator in figs. 1 and 2 is displaced, and utilized for the reservoir. The drum is provided with three scoops A. A tube C, passing above the water-level, furnished with a hood B, is fixed on the circular front in the inside of the case; the scoops passing under the hood. A compression box E, containing the injector F, is placed in the water reservoir, and the overflow-pipe G limits the height to which the water will rise.

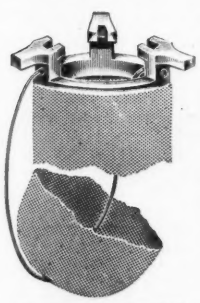
The action of the meter is as follows: During the revolution of the drum, the small scoops A, on coming in contact with the water in the meter, take up some bubbles of gas and convey them under the hood B. The tube C, which is a continuation of the hood, is in communication, by the opening D, with the compression box E. The gas bubbles accumulate in this box, and press upon the water at the bottom of the injector F; and when the meniscus is broken, a portion of the gas compressed in the box E escapes suddenly by the injector, and throws to the upper part of the meter all the water it contains. Following this action the tube F fills itself again up to the height of the water contained in the reservoir; and the same operations of accumulation of bubbles and projection of water are repeated continually during the working of the meter. All bubbles which make their way under the hood enter the box E, and escape by the injector, as already explained.

The meter described, having been tested and favourably reported upon, is accepted for official stamping; and the Paris Gas Company are having altered to the new style all their ordinary meters which are sent to the makers for repair.

SOME LIGHTING ACCESSORIES.

On making an inspection last week of the commodious showrooms in Farringdon Road of Messrs. Falk, Stadelmann, and Co.—that is to say, of the portion which is devoted to catering for the wants of the gas industry, for there are also other departments equally well served—attention was directed to some of the fresh features which are included in the new issue of the Incandescent Light Catalogue.

The well-known "Veritas" inverted mantles, it was learnt, are now being supplied in a new and improved quality, and having an extra heavy impregnation, with the object of considerably increasing their durability. Then, in connection with the "Veritas" inverted mantles, mention may be made of an idea which has been put into practice, and is considered specially suitable for adoption with mantles used for lighting railway carriages, mills, billiard-tables, &c. As shown by the illustration, this consists of an asbestos cord passed through the bottom of the mantle, and fixed at each end to the ring. It is pointed out that, should the mantle become fractured or detached from the ring, the asbestos cord will prevent it from dropping, and hold it sufficiently together to be serviceable until it can be replaced. With regard to inverted burners, there is an "Improved Veritas" type, which is claimed to give 65-candle power with a consumption of only 3 cubic feet of gas per hour. These include the new patent spring globe holder, air-regulating cup with lever permitting of the adjustment of the burner while alight, and an improved gas-adjuster with thumbscrew of black non-heating material. Another pattern which should secure its fair share of popularity is the "Veritas Self-Intensifying" lamp. This, as will be seen, is provided with an inner glass cylinder, but is in other respects similar to the "Improved Veritas" type just alluded to. The inner cylinder, which is carried by a brass gallery, is, however, stated to increase the candle power of the burner by 30 per cent. A new intermediate size is being introduced of some of the firm's well-known patterns of inverted burners; and this is specially suitable for domestic lighting—the gas consumption being small and the illuminating power good. These are named respectively the "Veritas-Medium," the "Vindex-Medium," and the "Ariel-Medium." The "Vesta-Veritas" English made Graetzin type of burner is much in evidence. It is made in two sizes, with brass or china casing; and the efficiency of the largest is stated to be 110 candles for a consumption of less than 4 cubic feet of gas per hour. Among the gas lighters, is noticed the "Climax," which is conveniently arranged. It consists of a tube with a gas-collecting cup at the top, partially surrounding the igniting substance; and it is provided with a rotary lever action.



Fractured Mantle held together by Asbestos Cord.

The "Veritas Self-Intensifying" Lamp.

LARGE GAS-MAIN UNDER THE HARLEM RIVER.

In order to guard against a possible shortage in the supply of gas in the borough of the Bronx, the Consolidated Gas Company of New York some time ago decided to lay a 48-inch main in the bed of the Harlem River; and the work was started in April. The main leaves the Manhattan shore at a point rather high up the river, and the length laid, at varying depths, in the bed is 550 feet. The following brief particulars of the work are taken from an illustrated article on the subject in the publication, bearing the title "Gas Logic," which is issued monthly under the auspices of the Company.

For carrying on the operations, some caissons were sunk on the banks of the river to a depth of 50 feet. In order to obviate the possibility of the main being injured by dropped anchors, it is laid on blocks with a reinforced concrete "decking" over it. It is made up of sections 12 feet in length; two being jointed together, lowered into the water, and placed on the blocks by divers.

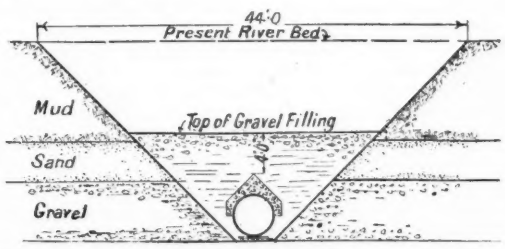


Diagram Showing the End of the Main Buried in Gravel under the Bed of the River.

The position of the main is shown in the above diagram. It will be seen that it lies at the bottom of a V-shaped excavation, the sides having a slope of 45°, which had to be made through mud, sand, and gravel, all below the present river bed. The main rests upon oak wedges and yellow pine blocking 3 feet in length, 12 inches wide, and 4 inches thick, so that it cannot shift its position; and the "decking" over it is cone-shaped, to protect it from injury.

CONDENSATION & NAPHTHALENE EXTRACTION.

The following is an abstract translation of an article on this subject in a recent number of the "Journal für Gasbeleuchtung," by Dr. E. Ott, the Chemist at the Schlieren Gas-Works of the Corporation of Zürich.

The author observes that views on the matter have recently undergone considerable change. It was formerly believed that gas must be kept at a high temperature (95° to 105° Fahr.) as far as the inlet of the naphthalene washer, in order that the washer might be worked with as small a consumption of oil as possible; and this view is widely held at the present time. But now the more correct view is gaining acceptance—viz., that only well-cooled gas should enter the washer. It is true that warm anthracene oil dissolves more naphthalene than cold; but, on the other hand, warm gas carries much more naphthalene than cold gas into the washer, and this is a far more important point. The tension of naphthalene vapour, and consequently the proportion in the gas, increases considerably with the temperature, as the following figures given by Bunte indicate.

Temperature. Deg. Fahr.	Vapour Tension of Naphthalene. Millimetres of Mercury.	Grains of Naphthalene per 100 Cubic Feet of Gas.
32	0·022	5·99
50	0·047	9·75
68	0·080	24·60
86	0·135	39·50
104	0·320	83·47

[These figures may be compared with those obtained by independent investigation by R. W. Allen, *vide* "Journal," Vol. LXXV., p. 673.]

If the gas is cooled only a little before it enters the naphthalene washer, it will carry more naphthalene into the latter than if it is thoroughly cooled, because the tar has been able in the latter case to dissolve considerably more naphthalene. This has been proved to be, in fact, the case by practical tests made at the Schlieren works. Up to February last, one stream of gas through the naphthalene washer amounted to about 6,707,000 cubic feet, at a temperature of about 95° Fahr.; and the consumption of oil corresponded to 5 oz. to 6 oz. (weight) per 1000 cubic feet of gas. The spent oil from the first chamber of the washer contained about 23 per cent. of naphthalene, and the oil from the fourth chamber, about 12 per cent. Later, the temperature of the ingoing gas was reduced, by the use of two condensers anterior to the washer, to about 68° Fahr., so that the temperature of the washer itself fell to 68° to 77° Fahr. It was then found that at least 14,120,000 cubic feet of gas could be passed through the washer with the same quantity of oil; so that there was effected an economy in oil consumption of over 50 per cent. The oil from the first chamber then contained 21 per cent. of naphthalene, and that from the fourth chamber about 11 per cent. On cooling a portion of the oil from the latter chamber to 14° Fahr., no naphthalene separated out—proving the oil had not been in use too long. Estimations by means of picric acid showed that the amounts of naphthalene left in the gas were practically negligible, whereas prior to the washer about 8·74 grains per 100 cubic feet were found.

There is no point, so far as naphthalene extraction is concerned, in cooling the gas below (say) 59° to 68° Fahr.; and lower temperatures would be difficult to maintain in summer. Neither can further cooling be recommended for works without naphthalene washers, as experiences in England have shown that at lower temperatures oils are extracted which otherwise would be retained in the gas and would first be condensed in the mains, where they would dissolve any naphthalene which might also have been condensed there. At some English gas-works, over-cooling of the gas has resulted in naphthalene obstructions; while at others working similarly in other respects, but not cooling the gas to such a low temperature, there have been no such obstructions. It appears advisable to cool the gas rapidly to the desired temperature, because when it is cooled slowly large quantities of tar separate at a comparatively high temperature, and are then capable of dissolving only a little

naphthalene, whereas, if gas is cooled rapidly to 59° to 68° Fahr., the greater part of the deposited tar takes this temperature and is in better case for dissolving naphthalene. Hence, the most powerfully acting washers are the best, with or without the bye-passing of the atmospheric condenser. If there is a long train of apparatus between the condenser and the ammonia washer, as is often the case when naphthalene and cyanogen recovery washers are employed, the gas may in summer time again become hot before reaching the ammonia washer; and as the latter then fails to absorb well, it may be necessary to insert another rapid condenser immediately anterior to the ammonia washer. Figures are given for a "Standard" washer at the Zürich Gas-Works, showing that when the temperature at the inlet rose from about 66° to 79° Fahr., the quantity of water used was greatly increased, with a consequent diminution in the strength of the liquor produced while the effluent gas began to show traces of ammonia. On putting in an intermediate condenser, however, and thereby reducing the temperature of the ingoing gas to 66° Fahr., the consumption of water was again reduced, the strength of the liquor raised, and the outgoing gas rendered clean to test papers. Incidentally, also, the reduction of temperature improved the working of the cyanogen washer, by increasing the strength of the cyanogen sludge.

With the old method of working, sludge containing only about 8 per cent. of prussian blue could be obtained; and the requirements of the p urchasers for a stronger sludge could not be met, while dealing with gas from the vertical retorts, till the special condenser was inserted in the train of apparatus, whereupon the sludge acquired a strength of 10 to 11 per cent. of prussian blue. The explanation most probably lies in the fact that the ammonia absorbed in larger quantities at the lower temperature renders the sludge more strongly alkaline, and consequently better capable of retaining the cyanogen which comes into the washer. The increased amount of ammonia in the sludge does not (as an example for which a calculation is made by the author shows) result in a financial loss, because the increased proportion of blue more than compensates for any loss due to the ammonia not being recovered in a concentrated state. Hence, thorough cooling of the gas at this stage must on this account be strongly recommended.

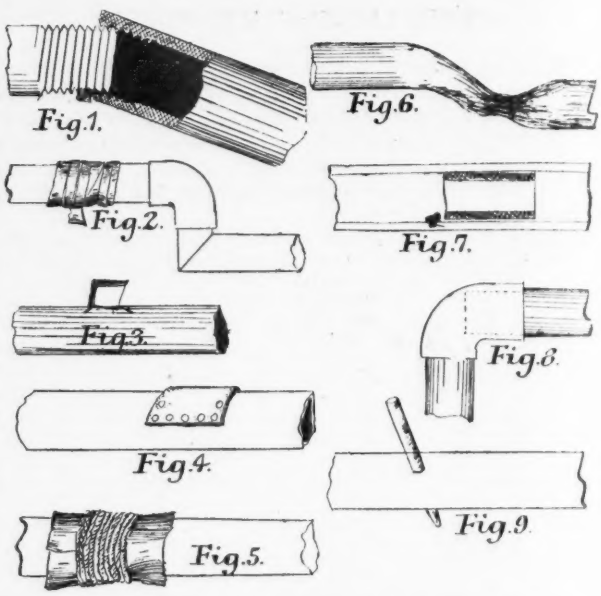
DISQUALIFIED PIPES AND CONNECTIONS.

The following article, from a correspondent, appeared in a recent number of the "American Gaslight Journal."

In almost every house there lives someone who knows enough of mechanics to tinker with gas pipes and connections; but this tinkering is often disastrous to the piping system of the house or office building. Caretakers often injure pipes, meters, tanks, &c., in their efforts to make some changes in the pipes or to instal a new part. I have seen first-class pipes and adjoining apparatus sadly distorted by the careless handiwork of persons who had no right to interfere with them. Still, of course, there are often excuses for tinkering with the pipes. For instance, when a pipe begins to leak, and the man of the house detects the point of leakage with the dangerous light, he feels that he is competent to make a few adjustments, stop the leak, and save the cost of the repair by an experienced man, with the result that the gas companies have more or less trouble all the time. In some American cities and towns, there are numbers of the company's men always out among the users of the gas to closely watch things; and if there is anything wrong, they are quick to detect it and effect a remedy. No such precaution, however, is taken by the smaller concerns in the country towns; and, regardless of the care exercised by the suppliers of gas, there are always certain fractures in piping systems which are repaired or patched improperly.

Not long ago, I noticed a man tinkering at a gas-pipe joint. As the two ends of the pipe passed through partitions, and as one partition wall had settled a little, one section of the pipe drooped so as to prevent the joining of the threads correctly. But the man inserted the end into the joint of the corresponding pipe, and proceeded to screw it up, with the result that he had an adjustment like that shown in fig. 1. The threads were thrown out of line, as shown; but the man turned the joint as far as possible, and left it. Of course, leakage resulted, and a regular pipe fitter had to be sent for, as he should have been in the beginning. In order to restore this union to the proper shape, the threads of the pipe had to be recut.

Persons not accustomed to repairing leaks in pipes in houses or factories should not attempt to do so; but the precaution is not taken. There are always people who will strive to fix things for the sake of tinkering, or to save the expense of a gas-fitter's bill. Hence, in one house where a pipe leaked, I found that the fracture in the pipe was first filled up with soap, and then a strip of banding bound about the place, as in fig. 2. I have seen men express their delight because they may have stopped a leak for the time being by winding it in this way. It is a slipshod method of doing things, and should not be tolerated. Of course, the banding works free in time, leaking begins again, and then the gas company are usually notified, and a man who understands repair work appears on the scene to substitute a new section of pipe for the split one. I once saw a fracture in a pipe closed for a time by means of a slim wedge of steel driven in, as illustrated in fig. 3. Then some resin was plastered about the edges, and the leak was checked for a short time. However, soon there was



an odour of gas, and trained workmen had to come and remove the entire joint, and replace it with a new strip of pipe.

Sometimes persons will go to the trouble of piecing on a patch of sheet metal, as seen in fig. 4. This is another crude way of repairing a bad place in a gas-pipe; and it cannot be done unless the fracture is near the end of the pipe, for it is necessary to insert a mandrel so as to head-up the rivets. While a patch like this is strong, and usually effective, it is difficult to use it on account of the need of drilling rivet-holes. Some bad places in gas-pipes are covered with wrappings of leather or felt, as shown in fig. 5. The application of a gummy material closes the splits or holes; and the binding of cloth or other stuff with cords, raw hide, or wire makes a firm emergency fixture. It is not intended that a repair job of this character should be lasting. The idea is to bind up a leak, and then get to work and make it right with new parts when convenient.

There are not only leaks to contend with, but collapsed pipes and twisted sections are often encountered. Sometimes the walls of pipes are crushed by the action of the partitions or floors through which the pipes may pass. In this age of competition among building contractors, edifices are often put up before the timber is thoroughly seasoned, with the result that the woodwork is strained and warped in the finished structure. The piping which happens to extend through such work gets crushed, bent, and distorted. Fig. 6 shows the condition of a gas-pipe crushed in this way. The best—in fact, the only—way is to remove the section, and replace it with a new one. But I have seen such places restored by heating the pipe with a bunsen burner and straightening it, and then driving a rod of the size of the interior of the pipe through to expand the wall to the right proportions. Pipe plugs are a trouble. If inserted, as shown in fig. 7, to check a pinhole leak in the pipe, the passage-way of the pipe is cut off just this much, and the flow of gas hindered.

Concerning the checking of the flow of gas, the proprietor of a dining-room once reported that he was unable to get the usual supply of gas for his table lights. An examination revealed the condition shown in fig. 8. It seems that the joint had sprung a leak. One of the workmen of the place then turned the threaded section of pipe into the elbow until the section protruded into it to the extent of almost checking the flow of gas, as represented by the dotted lines. On the removal of this combination, the flow of gas was corrected. One often finds pins driven into leaking holes in pipes. I saw a wire nail used and driven with such force that the point passed entirely through the pipe, coming out below, as shown in fig. 9. Soldering is better than nailing up pinholes, as everybody knows; but it is not possible for the gas-fitter to control the actions of the home artisans. About all he can do is to be ready to repair any damage done by the tinkerer.

Extension of High-Pressure Gas Lighting in Berlin.— It is reported in the "Journal fur Gasbeleuchtung" of the 20th inst., that the Municipality of Berlin have ordered from the firm of Ehrich and Graetz 450 high-pressure gas-lamps of 2000 hefners (1800-candle) power, and 60 of 1000 hefners (900-candle) power. This will increase the number of Graetzin high-pressure lamps in use in the streets of Berlin to about 1800, totalling nearly 4 million hefners in illuminating power.

Death of Mr. A. H. Claypole.—The death occurred recently at the age of 73, of Mr. Alfred H. Claypole, J.P., a resident at Camberley for about 45 years, during the greater part of which time he was in business as a chemist and druggist. He was one of the founders of the Yorktown and Blackwater Gas Company, and helped in great measure to promote the success of the concern. He had been a Director almost from the commencement; and for many years he was Chairman of the Board.

REMOVAL OF SULPHUR BY REHEATING.

The Hall Process at Portland (Oregon).

In the "JOURNAL" for the 1st of March last, an abstract was given of the specification of a patent taken out by Mr. E. L. Hall, of Portland, Oregon (U.S.A.), for a process "to remove from gas, after it has been purified as much as possible by hitherto known methods, the organic compounds of sulphur which remain therein, and which hitherto have been considered unremovable." The process has been in successful operation at the Portland Gas-Works for the last two years and more; and we have received from Mr. H. M. Papst, the General Manager of the Company (through Mr. Frederic Egner, who was recently in the city), the following particulars in regard to it.

The good results obtained from the use of this process have shown themselves not only in the laboratory, but also in the plainly expressed satisfaction of the public. Information as to the operating and maintenance cost of the plant can best be furnished by submitting the figures of the Company for 1909. The figures for the amount of sulphur remaining after reheating and secondary purification—being monthly averages of street gas, and including set-backs from various causes, such as small purifying capacity and poor purifying material of the secondary purifier and lack of blast pressure—hardly do the process full justice. The total amount of gas reheated was 817 million cubic feet, with a minimum of 4 million cubic feet per day.

Month.	Heating Oil, Gallons per 1000 Cub. Ft.	Labour per 1000 Cub. Ft.	Grains of Organic Sulphur per 100 Cub. Ft.		Removed.
		Dols.	Before.	After Reheating.	
Jan.	0·35	0·0026	58·8	16·9	41·9
Feb.	0·21	0·0025	50·0	17·3	32·7
March	0·18	0·0030	49·0	15·5	33·5
April	0·50	0·0042	58·8	14·2	44·6
May	0·49	0·0032	53·9	15·3	38·6
June	0·55	0·0031	68·5	18·0	50·5
July	0·56	0·0035	68·9	20·8	48·1
Aug.	0·48	0·0031	66·7	18·2	48·5
Sept.	0·42	0·0026	57·8	14·7	43·1
Oct.	0·33	0·0024	62·3	15·5	56·8
Nov.	0·31	0·0020	62·1	18·8	43·3
Dec.	0·30	0·0018	49·2	18·1	31·1
Annual report	0·35	0·0026	58·8	16·9	42·9

I would consider the following a fair estimate of what the plant will do:

0·50	0·0026	60·0	13·0	47·0

This shows an average cost of reheated gas for the year, including labour and material, of $0·075. Should producer gas be used instead of oil for heating, with coal at $3·50 per ton of 2000 lbs., containing (say) 12,000 B.Th.U. per pound (Pacific Coast coals), it would require 67,500 B.Th.U. (the heat units in half-a-gallon of California crude oil), or 67,500 ÷ 12,000 of coal, or 5·6 lbs. If the producer efficiency were 75 per cent., this would amount to 7·5 lbs. at $0·0022, or $0·0165.

The operation of the process is extremely simple and readily understood, being merely an alternate reheating of the two shells filled with fire-brick chequerwork; that is to say, while gas is passed through one, the other is being heated. The ground space can be figured as being equal to a fourth the generating capacity of the works if water gas is manufactured, and also one-fourth the purifying capacity of the primary purifiers. In addition to the above, condensers of the usual design are used to cool the gas from 150° Fahr. to the temperature desired for purification. The apparatus should be connected after the usual purifiers, and ahead of the station meter, so that the exhausters will force the gas through the primary purifiers, reheater, coolers, secondary purifiers, and station meter into the storage holder.

The total repair on the reheating plant, outside of the rechequering, amounted to $125. The life of the chequers should be indefinite, since neither oil nor extreme heat is present to disintegrate the brickwork. Repairs to the brickwork of the producers, in which solid fuel is used, should also be low in maintenance, since the best producer practice has demonstrated low heats in operating.

In conclusion, Mr. Papst said he should like to draw the attention of the gas fraternity to the fact that companies who have been limited in their choice of raw materials to those low in sulphur content may, by using the reheating process, select a cheaper coal, which will of itself tend to reduce the price of all raw materials by increasing the number of available ones. A difference of only 50 c. per ton in the price of two coals—one low and the other high in sulphur—means 5 c. per 1000 cubic feet of increased profits. He adds: "I feel satisfied this is the cheapest process ever invented for the removal of organic sulphur."

In the letter accompanying the preceding particulars, Mr. Egner says: "I believe there is something in this process, and possibly some English gas managers might wish to take up the matter with Mr. Papst. Plant for carrying out the process is now being erected at Los Angeles, California, at one of the works of the Gas and Electric Company, of which Mr. W. B. Cline is President."

ANALYSIS OF FERROCYANIDES.

In the "JOURNAL" for the 25th of January, we gave an abstract of a long paper read before the Manchester Section of the Society of Chemical Industry by Dr. F. W. Skirrow, containing laboratory notes made by him on the estimation of ferrocyanides. We have now received from Dr. Harold G. Colman a reprint from the "Analyst" for last month of a paper on the subject lately read by him before the Society of Public Analysts. It was a second communication; the first having been read rather more than two years ago, and the full text, with notes of the discussion, given in the "JOURNAL" for July 21, 1908 (p. 171). In his paper Dr. Colman stated that the Feld method of estimating ferrocyanides gave very reliable results. Dr. Skirrow's determinations, however, seem to throw doubts on the accuracy of the method. The experience of this investigator being entirely contrary to that of Dr. Colman, it seemed to the latter advisable to publish a representative set of the actual figures obtained. This he has done in his second paper, which we give below in its entirety, with the remarks thereon. In order, however, to make the subject more intelligible, we reproduce from the text of Dr. Skirrow's paper, contained in the "Journal of the Society of Chemical Industry" for March 31, the conclusions arrived at by him as the result of his investigations.

SUMMARY OF DR. SKIRROW'S INVESTIGATIONS.

1.—In the Feld method for the estimation of ferrocyanides, some loss of hydrocyanic acid takes place on boiling the ferrocyanide solutions with caustic soda and excess of magnesium chloride under the conditions of the test. A 99·5 per cent. yield of hydrocyanic acid may be obtained on distilling mercuric cyanide with sulphuric acid in presence of chloride, if the concentration of the sulphuric acid be not allowed to become too great. If this distillation, however, be carried out in presence of the other products of the decomposition of the ferrocyanide which are present in the test, a less yield than the above is obtained. Furthermore, it seems probable that under the conditions of the test ferrocyanide is not completely converted to mercuric cyanide.

2.—In the zinc sulphate method for the estimation of ferrocyanide, it is advantageous to use more concentrated solutions of ferrocyanide and of zinc sulphate than those generally adopted. With the more concentrated solutions, a sharper end-point is obtained, and the effect of the presence of excess of alkali sulphate is minimized; the end-result in presence of excess of the sulphate of the alkali metal in question being the same as in absence of excess of the sulphate if the precipitated solution be allowed to stand for a quarter to half an hour before completing the titration. It is thus unnecessary to regulate the amount of sulphate present so finely, provided we are dealing with the ferrocyanide and sulphate of the same alkali metal. This has been shown both in the titration of the potassium salt and of the sodium salt. In the titration of sodium ferrocyanide, it is better to use a zinc sulphate which has been standardized against pure sodium ferrocyanide, though results of comparative accuracy can be obtained using a solution which has been standardized against potassium ferrocyanide, provided that sufficient potassium sulphate be added and the solution allowed to stand.

3.—In the separation of ferrocyanide from carbonyl ferrocyanide by alcohol, the greater accuracy of the method in the presence of caustic soda is indicated, and the advantage of washing the precipitate finally with absolute alcohol, draining and titrating direct in presence of the filter-paper, is pointed out.

4.—In estimating the ferrocyanide in the residues obtained after extraction of spent oxide of iron with carbon bisulphide, it is shown that a higher result is obtained if the alkaline solution be boiled and filtered before proceeding with the estimation. On boiling, some dissolved iron is precipitated which would otherwise cause precipitation of ferrocyanide on acidification.

Lastly, caustic soda does not extract the whole of the blue from oxide, there being some varying residue of blue which is difficultly soluble in caustic soda, and is probably in the form of the calcium-iron double salt.

DR. COLMAN'S PAPER.

Two years ago I read a paper before the Society on the "Commercial Analysis of Ferrocyanides," in which I stated that the Feld method of estimation gave very reliable results. Recently, however, F. W. Skirrow has published a series of determinations which seem to throw doubts on the accuracy of the method; his experiments, starting from known quantities of ferrocyanide and of cyanide, giving results from 3 to 4 per cent. low. Skirrow's experience is entirely contrary to mine; and as I have largely employed the Feld method during the past few years, both for the analysis of commercial products and of the pure salts, it seems advisable to publish a representative set of the actual figures obtained.

The Feld method is, briefly, as follows: A quantity of ferrocyanide, amounting to from 0·3 to 0·5 gramme of potassium ferrocyanide or its equivalent, is dissolved in water, heated to boiling with 10 c.c. of N/1 caustic soda, 15 c.c. of 3N magnesium chloride solution added, and the boiling continued for five minutes. [If free cyanide is also present, the hydrocyanic acid in this form then distils over, and may be condensed and collected for analysis; the boiling being in that case continued for a longer

period.] There are then added 100 c.c. of boiling N/10 mercuric chloride, and the boiling continued for a further ten minutes; all ferrocyanide being thus converted into mercuric cyanide. The hydrocyanic acid in the latter is recovered by distilling for 20 to 30 minutes with 30 c.c. of 3N sulphuric acid; the condensed distillate being collected in 25 c.c. of N/1 caustic soda, and, after addition of a crystal of potassium iodide, titrated with N/10 silver nitrate until a permanent yellow precipitate of silver iodide makes its appearance.

From the results of his tests, Skirrow concludes that there are two sources of error in the method: (1) That on boiling the ferrocyanide solution with magnesium chloride solution and magnesium hydroxide, some hydrocyanic acid is evolved; and (2) that loss of hydrocyanic acid occurs either in conversion of the ferrocyanide into mercuric cyanide or in the distillation with acid.

Action of Magnesium Chloride Solution.

With regard to the first point, the two following tests, made with pure potassium and sodium ferrocyanides, may be given, in which boiling with maguesium chloride was prolonged to 25 minutes.

Weight of Salt Taken.	N/10 Silver Nitrate Solution Used. 25 Min. with $MgCl_2$.	After $HgCl_2$, &c.	Total.	Theory.
0·3350 $K_4Fe(CN)_6.3H_2O$	0·15 c.c.	23·65 c.c.	23·8 c.c.	23·79 c.c.
0·4140 $Na_4Fe(CN)_6.10H_2O$	0·15 c.c.	25·45 c.c.	25·6 c.c.	25·66 c.c.

These and other tests of a similar character are so far in agreement with Skirrow that they show a loss of hydrocyanic acid on long-continued boiling with the magnesium chloride solution, though the extent of the loss (0·6 per cent.) is much smaller than he found; and it will also be seen that there is no absolute loss of cyanide—the total yield of hydrocyanic acid being practically in accord with theory.

Where, on the other hand, the boiling with magnesium chloride is continued only for the specified five minutes, I have found in a large number of tests that no appreciable evolution of hydrocyanic acid occurs; a single drop of N/10 silver nitrate solution always producing a decided yellow cloudiness in the alkaline distillate. The two following tests may be given as an example.

Weight of Salt Taken.	N/10 Silver Nitrate Solution Used. 5 Min. with $MgCl_2$.	After HgCl , &c.	Total.	Theory.
0·3240 $K_4Fe(CN)_6.3H_2O$ . .	nil	23·05 c.c.	23·05 c.c.	23·01 c.c.
0 3675 $Na_4Fe(CN)_6.10H_2O$ . .	nil	22·75 c.c.	22·75 c.c.	22·78 c.c.

In testing for ferrocyanide in the absence of cyanide, correct results are therefore obtained if boiling with magnesium chloride is not continued longer than the specified five minutes. When, on the other hand, a mixture of cyanide and ferrocyanide is being analyzed, and the boiling must be continued for longer than five minutes to drive off all hydrocyanic acid present as cyanide, the tendency from this source of error will be to give rather too high results for cyanide, and correspondingly low figures for ferrocyanide. It is found, however, that, with the quantities of cyanide present in such analyses, ten minutes' fairly quick distillation is sufficient to remove the hydrocyanic acid present as cyanide, without also driving off material quantities of the hydrocyanic acid present as ferrocyanide, as shown by the following tests.

(1) 0·3006 gramme $K_4Fe(CN)_6.3H_2O$ (= 21·35 c.c. N/10 $AgNO_3$) was dissolved in water, mixed with 10 c.c. of pure sodium cyanide solution (12·15 c.c. N/10 $AgNo_3$), and analyzed by Feld's method.

	Found.	Theory.
After ten minutes' boiling with $MgCl_2$ . .	12·15 c.c. ..	12·15 c.c.
After $HgCl_2$ and distillation with H_2SO_4 .	21·30 c.c. ..	21·35 c.c.

(2) 0·4094 gramme $Na_4Fe(CN)_6.10H_2O$ (25·37 c.c. N/10 $AgNO_3$) and 10 c.c. sodium cyanide solution (12·15 c.c N/10 $AgNO_3$) treated in the same manner.

	Found.	Theory.
After ten minutes' boiling with $MgCl_2$ . .	12·10 c.c. ..	12·15 c.c.
After $HgCl_2$ and distillation with H_2SO_4 .	25·50 c.c. ..	25·37 c.c.

Experiments Starting from Sodium Cyanide Solution.

Skirrow found further that, starting with cyanide solution, and converting this into ferrocyanide by the action of ferrous sulphate solution and caustic alkali, the yield of hydrocyanic acid on subsequent analysis by the Feld method was from 3 to 4 per cent. less than that found by the direct titration of the original cyanide solution with N/10 silver nitrate. A set of experiments was therefore made with a solution of pure sodium cyanide prepared by distilling hydrocyanic acid into a solution of pure caustic soda; and 25 c.c. of this solution required 30·4 c.c. of N/10 silver nitrate on direct titration.

Successive quantities of 25 c.c. of this solution were converted into ferrocyanide by the addition of 25 c.c. of N/1 caustic soda and a solution of 0·5 gramme of ferrous sulphate crystals; the mixture being allowed to stand an hour, with occasional shaking. The whole was then analyzed by the Feld method (N/10 silver nitrate being used), with the following results.

5 Min. after $MgCl_2$.	After $HgCl_2$.	Total.	Theory.	Loss. Per Cent.
Nil ..	30·20 c.c. ..	30·20 c.c. ..	30·4 c.c. ..	0·66
Nil ..	30·25 ,, ..	30·25 ,, ..	30·4 ,, ..	0·50
Nil ..	30·35 ,, ..	30·35 ,, ..	30·4 ,, ..	0·16
Nil ..	30·30 ,, ..	30·30 ,, ..	30·4 ,, ..	0·33
Nil ..	30·25 ,, ..	30·25 ,, ..	30·4 ,, ..	0·50
		Average		0·43

Here, again, while a small loss was always found (averaging about 0·5 per cent.), this is much less than the 3 to 4 per cent. observed by Skirrow. It was further noticed that the residual liquid in the flask after distillation, which is normally a yellow solution coloured by ferric sulphate, and containing a precipitate of mercurous chloride, had in all cases a greenish tinge, indicating the presence of undecomposed iron ferrocyanides. It seemed most probable that the formation of such insoluble ferrocyanides would be due to the presence of ferrous hydroxide in the liquid analyzed, owing to an excess of ferrous sulphate having been used for conversion of the cyanide into ferrocyanide, as the presence of ferrous hydroxide might be expected to result in the formation of some ferrous ferrocyanides, which are known to be more stable towards alkalies than the ferric ferrocyanides. To avoid this formation, attempts were made to remove the excess of ferrous hydroxide from the solution before analysis; but these were unsuccessful, as it was found impracticable to wash the precipitate free from ferrocyanide. A further test was therefore made in which, previous to analyzing the solution, the ferrous hydroxide was oxidized to ferric hydroxide by the addition of a few drops of ammonium persulphate solution. The result then obtained was as follows.

After $MgCl_2$.	5 Min. after $HgCl_2$.	Total.	Theory.	Loss.
0·6 c.c. ..	29·8 c.c. ..	30·4 c.c ..	30·4 c.c. ..	Nil

In this case it will be seen that the total hydrocyanic acid obtained was in accordance with theory, although, owing to the action of the slight excess of persulphate used, a small amount of ferrocyanide was converted into cyanide; this quantity being evolved on boiling with magnesium chloride. The residual solution in this case did not show the slightest green tinge.

To ascertain further the effect of ferrous hydroxide, a mixture of pure potassium ferrocyanide with ferrous sulphate solution and caustic soda was made and analyzed, with the following result: 0·3272 gramme $K_4Fe(CN)_6.3H_2O$ (= 23·25 c.c. N/10 $AgNO_3$) was mixed with 0·5 gramme $FeSO_4.7H_2O$ and 25 c.c. NN/1.NaOH, and the mixture analyzed by Feld's method.

After $MgCl_2$.	5 Min. after $HgCl_2$, &c.	Total.	Theory.	Loss. Per Cent.
Nil ..	22·8 c.c. ..	22·8 c.c. ..	23·25 c.c. ..	1·9

The residual solution in this case had a decided green colour.

The loss observed by Skirrow in this and many of his other experiments appears, therefore, to be due largely to the fact that an excess of ferrous hydroxide was present in the solutions tested, which is not the case when the test is carried out under normal conditions. The reason that Skirrow also obtains a much greater loss during the boiling with magnesium chloride solution is, however, unaccounted for; and the only suggestion that occurs to me is that it may have been due to some impurity present in the magnesium chloride used. In the tests given above, pure crystalline magnesium chloride was employed throughout.

Generally, therefore, these tests seem to show that the Feld method, when carried out under the conditions specified in the former paper, gives results which are substantially accurate.

Analysis of Pure Salts.

As indirect evidence of the accuracy of the method, the following complete analyses of various ferrocyanides which had been prepared in as high a state of purity as possible may be quoted. In these analyses, the basic metals and the iron were determined in the usual manner—the cyanogen by Feld's method, and the water by heating the salt in a current of air, and collecting in a calcium chloride tube the moisture evolved. Determination of the water by loss of weight on heating gives unsatisfactory results.

Potassium Ferrocyanide.

			Calculated for $K_4Fe(CN)_6.3H_2O$.
K .	0·5395 grm. gave 0·4424 grm. K_2SO_4 .	K = 36·80 ..	37·02
Fe.	0·6035 ,, took 14·3 c.c N/10 $K_2Cr_2O_7$.	Fe = 13·24 ..	13·23
CN .	0·3028 ,, took 21·45 c.c. N/10 $AgNO_3$.	CN = 36·84 ..	36·96
H_2O .	0·8874 ,, gave 0·1118 grm. H_2O .	H_2O = 12·60 ..	12·79
		99·48 ..	100·00

Sodium Ferrocyanide.

			Calculated for $Na_4Fe(CN)_6.10H_2O$.
Na .	0·8315 grm. gave 0·4847 grm. Na_2SO_4 .	Na = 18·86 ..	19·00
Fe .	0·7518 ,, took 15·5 c.c. N/10 $K_2Cr_2O_7$.	Fe = 11·53 ..	11·55
Cy .	0·3253 ,, took 20·15 c.c. N/10 $AgNO_3$.	CN = 32·20 ..	32·23
H_2O .	0·6418 ,, gave 0·2382 grm. H_2O .	H_2O = 37·12 ..	37·22
		99·71 ..	100·00

Calcium Ferrocyanide.

			Calculated for $Ca_2Fe(CN)_6.11\frac{1}{2}H_2O$.
Ca .	0·6912 grm. gave 0·1568 grm. CaO ..	Ca = 16·21 ..	16·06
Fe .	0·6912 ,, took 13·95 c.c. N/10 $K_2Cr_2O_7$	Fe = 11·28 ..	11·20
CN .	0·4688 ,, took 28·35 c.c. N/10 $AgNO_3$	CN = 31·46 ..	31·26
H_2O .	0·4120 ,, gave 0·1696 grm. H_2O ..	H_2O = 41·18 ..	41·48
		100·13 ..	100·00

Strontium Ferrocyanide.

			Calculated for $Sr_2Fe(CN)_6.14H_2O$.
Sr .	0·6224 grm. gave 0·3598 grm. $SrSO_4$ ..	Sr = 27·53 ..	27·40
Fe .	0·6224 ,, took 9·75 c.c. N/10 $K_2Cr_2O_7$	Fe = 8·76 ..	8·74
CN .	0·3464 ,, took 16·3 c.c. N/10 $AgNO_3$	CN = 24·47 ..	24·40
H_2O .	0·4166 ,, gave 0·1650 H_2O	H_2O = 39·61 ..	39·46
		100·37 ..	100·00

Magnesium Ferrocyanide.

			Calculated for $Mg_2Fe(CN)_6.12H_2O$.
Mg	0·5054 grm. gave 0·2384 grm. $Mg_2P_2O_7$..	Mg = 10·31 ..	10·21
Fe	0·4832 ,, took 10·15 c.c. N/10 $K_2Cr_2O_7$	Fe = 11·74 ..	11·73
CN	0·3419 ,, took 21·45 c.c. N/10 $AgNO_3$	CN = 32·62 ..	32·73
H_2O	0·3402 ,, gave 0·1544 grm. H_2O ..	H_2O = 45·37 ..	45·33
		..	
		100·04 ..	100·00

It will be seen that the figures are generally satisfactory, which would not be possible if the Feld method gave results from 3 to 4 per cent. too low, as found by Skirrow. This is particularly the case with the percentages of iron and cyanogen, for, whatever the exact degree of purity of the salts may have been in other respects, it is reasonably certain that all the iron and cyanogen were present in each case solely as the radical $Fe(CN)_6$; the theoretical ratio Fe : CN in this radical being 1 : 2·792. The actual ratio found in the analysis of the above five salts was as follows.

		Error per Cent.
K salt	Fe : CN = 1 : 2·783 ..	− 0·4
Na ,,	,, = 1 : 2·793 ..	Nil.
Ca ,,	,, = 1 : 2·789 ..	− 0·1
Sr ,,	,, = 1 : 2·793 ..	Nil.
Mg ,,	,, = 1 : 2·778 ..	− 0·5
Average	1 : 2·787 ..	− 0·18

It may be remarked that the number of molecules of water of crystallization found in some of the above salts does not agree with the statements found in the literature. Potassium ferrocyanide has long been known to crystallize with $3H_2O$, and sodium ferrocyanide, though still stated in many text-books to crystallize with $12H_2O$, has for many years been recognized as only containing $10H_2O$. Calcium ferrocyanide is usually stated to crystallize with $12H_2O$, and this is probably correct. But the crystals are very efflorescent, and the author has never succeeded in getting figures corresponding with that formula in different preparations, giving results varying between those required for 11 and $12H_2O$. Strontium ferrocyanide is described by Bette ("Annalen," 1836, XXII., 148) and Wyrouboff ("Ann. Chim. Phys.," 1868, [4] XVI., 287; 1870, [4] XXI., 271) as crystallizing with $15H_2O$; whereas, with several different preparations, the author finds only $14H_2O$. These crystals lose $7H_2O$ on standing in the air, and a further $6H_2O$ over sulphuric acid *in vacuo*. Apparently only one analysis of magnesium ferrocyanide has been published (Bette, "Annalen," 1836, XXIII., 115), leading to the formula $Mg_2Fe(CN)_6.10H_2O$, against $12H_2O$ found by the author; but Bette's figures are too incomplete and approximate to justify his formula. The magnesium ferrocyanide crystals lose $5H_2O$ on standing in the air.

Discussion.

Dr. LESSING said he commenced to use the Feld method shortly after it was introduced, five or six years ago, and at the beginning experienced some difficulty with it. He had then just completed some experiments relating to the decomposition of ferrocyanides by acids, and had found that the complex nature of the ferrocyanogen ion by no means prevented its decomposition by ordinary mineral acids. He had even found it possible to decompose some of the alkaline ferrocyanides with sulphur dioxide, liberating free hydrocyanic acid. This, of course, had made him particularly careful to see that no ferrocyanide was decomposed during the boiling with magnesium chloride; and he had never found any appreciable decomposition to occur, provided that Feld's original instructions were followed. Long-continued boiling was quite unnecessary; the only object of the boiling being to convert any free alkali into magnesium hydroxide. With regard to the green coloration observed by the author, he (Dr. Lessing) had frequently obtained this coloration at first, and the results were very discordant in consequence, since the ferrocyanide was not completely decomposed—a certain quantity of cyanogen remaining in the flask in the form of some compound of ferrocyanogen and iron. This difficulty was overcome by so adjusting the reagents that they were always present in approximately equivalent quantities—*i.e.*, starting with a certain quantity of caustic soda for the purpose of decomposing the original substance, an equivalent quantity of magnesium chloride was used, and the caustic soda and magnesium chloride were both adjusted in relation to the excess of iron that was present. Under these conditions, the green coloration was never obtained, and the results for total cyanogen were always satisfactory. With regard to the question of water of crystallization, he had found that, to make pure potassium or sodium ferrocyanide with a constant proportion of water, it was necessary to dry the recrystallized salt over a quantity of the same salt which itself had been previously freed from water of crystallization. Possibly this difficulty in obtaining as a basis for analysis a salt of constant composition might furnish a clue to the lowness of some of Skirrow's results.

Mr. J. L. FOUCAR said he also was in a position to corroborate the author's observations. He had not at first been able quite to understand Skirrow's results; but Dr. Colman had explained the main differences, especially with regard to the question of excess of ferrous hydroxide. The following results might be of interest: Sodium cyanide—by direct titration, 125·2 per cent. HCN; by Feld's method, 125·38 per cent.; by precipitation as silver cyanide, 125·13 per cent. Here, if anything, Feld's method seemed to give rather higher results than the others. A cyanogen liquor—4·14 lbs. of Prussian blue per gallon by Feld's method, 4·11 lbs. by titration with zinc. He had recently followed very closely some work the object of which was the investigation of this question, and he could state with certainty that, under standard conditions, the Feld method for the determination of ferrocyanide was at least as accurate as any other.

DETERMINING THE VOLATILE MATTER IN COAL.

The Director of the United States Geological Survey has permitted the "Journal of Industrial and Engineering Chemistry" to publish, in No. 7 of their second volume, the results of some experiments conducted in the Washington and Pittsburg Laboratories by Messrs. A. C. Fieldner and J. D. Davis.

As reprinted in recent numbers of the "Chemical News," the authors say: In view of the proposed revision of the official methods of coal analysis, it may be of interest to present certain experimental data bearing on the present official method for the determination of volatile matter in coal.

The experiments referred to were made primarily to ascertain the difference in the volatile matter produced by using a 20 cm. natural gas-flame as compared with the 20 cm. coal-gas flame. After starting the work, it was found desirable to investigate the influence of other factors, such as gas pressure, type of burner, and surface condition of the platinum crucible—*i.e.*, dull grey or polished. In order to eliminate the influence of variation in size and shape, three 30-grm. platinum crucibles, of practically the same capacity and weight, with closely-fitting covers, were used in all the experiments; it having been demonstrated by actual trial that the three crucibles each gave the same results.

As the crucibles had been regularly used for volatile determinations, both inner and outer surfaces had the dull grey appearance which platinum assumes when heated several times in the natural gas-flame. To protect the flame from air currents, the platinum triangle supporting the crucible was enclosed in a cylindrical sheet-metal shield, lined with asbestos, 15 cm. long and 7 cm. in diameter; the platinum triangle being placed 3 cm. below the top of the shield. The bottom of the crucible was exactly 8 cm. above the mouth of the burner.

The temperature measurements were taken on a parallel test, using the same crucible with the regular cover replaced by one of nickel. The thermo-couple, inserted through a small opening in the cover, was placed 2 mm. above the bottom of the crucible. The opening around the thermo-couple leads was closed with a cement of barium sulphate and sodium silicate.

The description of coals tested is given in Table I.

TABLE I.—*Description of Coals Tested.*

Coal No.	Type.	Locality.
1 to 3 } 10 to 12 }	Semi-bituminous . . .	Pocahontas (W. Va.).
4 to 6	Bituminous	Pennsylvania
7	Anthracite	Pennsylvania

INFLUENCE OF CHANGE IN GAS PRESSURE.

Coal gas can be burned efficiently at low pressures, 2 to 3 inches of water being sufficient; natural gas, owing to the much larger proportion of air required, must be supplied to the burner at higher pressure.

Table II. gives results obtained by varying the pressure from 1 to 13 inches of water.

TABLE II.—*Influence of Gas Pressure on Volatile Matter.*

[Natural gas; Tyrell burner; 20 cm. flame.]

Gas Pressure in Inches of Water.	Per Cent. Volatile Matter. Coal No. 1.	Coal No. 3.	Coal No. 6.	Maximum Temperature Deg. C.	Kind of Flame.
1	15·4	15·8	32·4	760	Yellow tipped.
2	15·2	16·7	..	..	—
3	15·4	16·7	32·3	780	Faint yellow tip.
4	16·3	..	32·7	..	—
5	16·7	16·5	32·6	800	Yellow tip just removed.
6	17·2	16·7	33·0	..	Long inner cone.
8	16·7	..	32·7	..	—
9	..	17·2	..	825	Well-defined inner cone.
12	17·2	16·9	32·7	..	—
13	17·1	17·1	32·5	845	Sharp, greenish inner cone.

Temperature (Deg. C.) during Volatile Determination on Coal No. 1 with Varying Pressures.

Time in Minutes.	Pressure in Inches of Water. 1.	3.	5.	9.	13.
0·5	180	185	180	220	320
1·0	450	440	450	480	550
1·5	590	590	605	635	690
2·0	670	670	710	720	780
2·5	725	740	765	775	825
3·0	745	760	790	805	840
3·5	750	770	800	815	848
4·0	755	780	803	820	848
4·5	760	780	803	820	848
5·0	760	780	802	823	848
6·0	760	780	800	823	847
7·0	760	780	800	823	845

The maximum temperature varies from 760 to 845° C. Coal No. 6 (a bituminous coal) gives practically just the same yield of

volatile matter throughout the series. The semi-bituminous coals, Nos. 1 and 3, are more sensitive to variations in temperature; the extremes being nearly 2 per cent. The maximum pressure, 13 inches, was used in all subsequent work with natural gas.

It has frequently been noted by the writers that during the early part of the seven-minute volatile process, the coke swells or puffs up to the lid of the crucible—oftentimes raising it slightly. On comparing such determinations with duplicates that did not swell, they were invariably found to be 1 to 2 per cent. lower in volatile matter. This peculiar swelling has been noticed only in the case of semi-bituminous coals. It is more apt to happen at the lower temperatures, and when the coal is kept perfectly level in the bottom of the crucible. The swelling can be prevented by simply tapping the crucible on one side, so as to settle the coal in an inclined position across one corner of the bottom of the crucible —thus preventing the formation of a film of fused coal across the crucible. Comparative results are given in Table III.

TABLE III.—*Variations Due to Swelling or Puffing-up of Coke in Crucible.*

	Coke Residue in Compact Lump in Bottom of Crucible.	Coke Residue Swelled Half-Way to Cover.	Coke Residue Swelled up to Cover.
Coal No. 1	16·7	16·2	15·3
	17·2	16·8	14·8
	17·1	16·0	15·2
	..	15·5	15·1
	..	15·7	15·7
	..	..	15·6
Average	17·0	16·0	15·3
Coal No. 2	17·0	15·4	15·4
	16·9		

TABLE IV.—*Influence of Different Types of Burners.*

Coal No.	Per Cent. Volatile. Fletcher.	Tyrell.	Bunsen.	Difference. Fletcher and Tyrell.	Fletcher and Bunsen.
	(*a*) NATURAL GAS.				
1	17·2	17·0	15·7	0·2	−1·5
2	17·0	16·8	15·8	−0·2	−1·2
6	32·8	32·6	32·6	−0·2	−0·2
4	31·8	31·3	31·2	−0·5	−0·6
5	31·5	31·5	..	0·0	..
			Average	−0·2	−0·8
Temperature	850° C.	850° C.	790° C.		
	(*b*) COAL GAS (PITTSBURG).				
1	17·0	16·7	16·3	−0·3	−0·7
6	33·0	32·3	..	0·7	..
5	31·7	31·4	..	−0·3	..
			Average	−0·4	
Temperature	855° C.	810° C.			
	(*c*) CARBURETTED WATER GAS (WASHINGTON).				
1	18·3	—	17·2	—	−1·1
11	18·6	—	17·8	—	−0·8
12	18·0	—	17·7	—	−0·3
10	18·7	—	18·4	—	−0·3
3	18·8	—	18·5	—	−0·3
2	18·2	—	17·6	—	−0·6
			Average		−0·6
Temperature	970° C.				

TABLE V.—*Temperature Measurements (Deg. C.). Coal No. 1.*

Time in Minutes.	(*a*) Fletcher Burner.	Tyrell Burner.	Bunsen Burner.	(*b*) Tyrell Burner.	(*c*) Fletcher Burner.
0·5	280	250	250	260	..
1·0	590	530	580	540	630
1·5	710	670	700	680	..
2·0	788	780	760	760	910
2·5	830	825	780	810	..
3·0	845	840	785	835	975
3·5	850	850	785	850	..
4·0	850	850	785	855	975
4·5	850	850	790	855	..
5·0	850	850	790	855	970
6·0	850	850	790	855	970
7·0	850	850	790	855	970

(*a*) Natural gas at 13 inches water pressure; 20 cm. flame.
(*b*) Pittsburg coal gas at 2·5 inches pressure; 20 cm. flame.
(*c*) Washington illuminating gas at 2·5 inches pressure; 20 cm. flame.

INFLUENCE OF TYPE OF BURNER.

It is reasonable to expect some lack of uniformity in volatile results where widely different types of bunsen burners are used. A burner with a large bore will give a larger flame volume, with a correspondingly increased heating effect. Determinations were made with the following types of burners on both natural and coal gas:—

(*a*) The simple bunsen burner, bore 9 mm.
(*b*) The Tyrell burner, bore 9 mm. ("Eimer and Amend's Catalogue," p. 80).
(*c*) The Fletcher, No. 5 *g* burner, bore 12 mm. ("Eimer and Amend's Catalogue," p. 80).

The results are given in Table IV.

The Fletcher burner gives slightly higher volatile matter than the Tyrell burner, with practically the same maximum temperature. The larger flame volume of the Fletcher burner heats up the crucible more rapidly, which increases the gas yield slightly. With the use of natural gas, the maximum temperature of the bunsen burner is 60° less than either the Fletcher or Tyrell burner. This produces a marked difference in the volatile matter in the case of the semi-bituminous coals. Evidently a burner like the Fletcher or the Tyrell, admitting of both gas and air regulation, is preferable to the simple bunsen.

INFLUENCE OF COMPOSITION OF GAS.

In order to determine the influence of composition of fuel gas, determinations were made over 20 cm. coal-gas flame and 20 cm. natural-gas flame; each gas being supplied to the burner at its proper pressure. The natural gas analyzed as follows:—

	Per Cent.
Carbon dioxide	0·1
Paraffin hydrocarbons	98·6
Nitrogen	1·3
	100·0

The coal gas taken from the mains of the gas company supplying artificial gas in Pittsburg (Pa.) analyzed as follows:—

	Per Cent.
Unsaturated hydrocarbons	7·5
Carbon dioxide	1·5
Oxygen	0·2
Carbon monoxide	8·9
Methane	44·8
Hydrogen	33·7
Nitrogen	3·4
	100·0

Both series of volatile determinations were made by the same analyst, using the same apparatus; the only difference being in the fuel gas used. The results are shown in Table VI.

TABLE VI.—*Difference Due to Using Natural or Coal Gas.*

Coal No.	Per Cent. Volatile Matter. Coal Gas, 2·5 In. Pressure.	Natural Gas, 13 In. Pressure.	Difference.
	(*a*) FLETCHER BURNER.		
1	17·0	17·2	+0·2
2	17·1	17·0	−0·1
6	33·0	32·8	−0·2
4	31·5	31·8	+0·3
5	31·7	31·5	−0·2
		Average	0·0
	(*b*) TYRELL BURNER.		
1	16·7	17·0	+0·3
6	32·3	32·6	+0·3
4	31·6	31·3	−0·3
5	31·4	31·5	+0·1
7	4·5	4·3	−0·2
		Average	+0·04
Temperature	855° C.	850° C.	

The temperatures are practically the same, and the variations in volatile matter average zero. It should be noted, however, that the natural gas was supplied to a carefully regulated burner at 13 inches pressure. If the comparisons were made at the lower pressures usually found in laboratories, the results by natural gas would be decidedly lower.

Table VII. gives a comparison of volatile matter obtained on the same samples of coal in two different laboratories of the Geological Survey. The Pittsburg laboratory used natural gas at 13 inches water pressure with a Tyrell burner; the Washington laboratory used illuminating gas at 2 inches pressure with the Fletcher burner. The height of flame was 20 cm. in each case.

TABLE VII.—*Comparison of Results Obtained in Different Laboratories.*

Coal No.	Per Cent. Volatile Matter. Pittsburg. Natural Gas, 13 In. Pressure. Tyrell Burner.	Washington. Illuminating Gas, 2·5 In. Pressure. Fletcher Burner.	Difference.
1	17·0	18·3	+1·3
2	16·8	18·2	+1·4
3	17·0	18·8	+1·8
4	31·3	32·5	+1·2
5	31·5	32·6	+1·1
6	32·6	33·4	+0·8
7	4·3	5·3	+1·1
10	17·7	18·7	+1·0
		Average	+1·2
Temperature	850° C.	970° C.	

From the previous experiment on natural and coal gas, closely agreeing results would be expected. Such, however, was not the case. As shown in the table, the Washington series averaged 1·2 per cent. higher than the Pittsburg. The maximum temperature of 970° C., noted in the Washington laboratory, was 120° higher than noted with either coal or natural gas at the Pittsburg laboratory. It had been supposed that the Washington illuminating gas was of a similar composition to that of the Pittsburg coal gas. This assumption, however, proved to be erroneous, as shown by the following analysis:—

TABLE VIII.—*Analysis of Washington Illuminating Gas.*

	Per Cent.
Carbon dioxide	3·0
Unsaturated hydrocarbons	10·4
Oxygen	1·0
Carbon monoxide	27·6
Methane	19·0
Hydrogen	33·1
Nitrogen	5·9
	100·0

The Washington gas consists entirely of carburetted water gas. It contains 26 per cent. less methane and 19 per cent. more carbon monoxide than coal gas. The replacement of methane by carbon monoxide decreases the flame volume very materially; and since the height of flame is the same in both cases, the heating effect of a low methane gas is, under ordinary laboratory conditions, considerably greater.

Chikashiga and Matsumato, in a paper submitted to the Society of Chemical Industry in 1904,* call attention to the disadvantages of uncarburetted water gas as a laboratory fuel, on account of the high temperature of the flame produced. They state that "comparatively thick copper wire and sheet, and even thin platinum wire, are easily melted and hard glass easily worked in its flame."

Another factor that may have contributed to the difference in temperature noted in the two laboratories is the surface condition of the platinum crucible. Constam, in a paper communicated to the Seventh International Congress of Applied Chemistry,† mentions "that the slower rise and the lower final temperature in dull platinum crucibles caused the yield of coke in them to be greater than in polished platinum crucibles."

As the crucibles used in all the experiments at the Pittsburg laboratory were very dull and tarnished in appearance, it was decided to polish them, and then run some determinations to check Constam's conclusions. The results are given in Table IX.

TABLE IX.—*Comparison of Volatile Matter Produced in the Same Crucible Before and After Polishing.*

Coal No.	Per Cent. Volatile Matter. Before.	After.	Difference.
10	17·0	18·1	1·1
3	17·0	18·1	1·1
6	32·6	33·3	0·7
Temperature	845° C.	890° C.	45° C.

Temperature Measurements (Deg. C.).—Coal No. 1.

Time in Minutes.	Before Polishing.	After Polishing.
0·5	250	320	240
1·0	30	550	590
1·5	670	690	750
2·0	780	780	840
2·5	825	825	880
3·0	840	840	890
3·5	848	848	890
4·0	850	848	890
4·5	850	348	890
5·0	850	848	890
6·0	850	847	890
7·0	850	845	890

In tests Nos. 1 to 6 inclusive [Table X.], Pocahontas coal was subjected to destructive distillation in an iron retort made from a piece of 1-inch gas-pipe, capped at one end and tubulated at the other. The retort was heated by means of a train of bunsen burners to a bright red heat in a furnace of asbestos board. A 20-gramme charge was used.

TABLE X.—*Volatile Matter by Distillation.*

Test No.	Time in Minutes.	Vacuum.	Per Cent. Volatile Moisture.
1	30	¾ in. mercury	18·3 (*a*)
2	45	,, ,,	18·7 (*b*)
3	45	,, ,,	19·4 (*b*)
4	45	,, ,,	18·2 (*b*)
5	40	4 in. water	18·8 (*b*)
6	45	Atmospheric pressure	18·7 (*c*)
		Average	18·7
7	7	Atmosphere of CO_2	18·5 (*d*)
8	7	,, ,,	18·3 (*d*)
9	7	,, ,,	18·6 (*d*)
		Average	18·5
		Official method	19·3

(*a*) Retort weighed. (*b*) Coke weighed. (*c*) Gradual heat.
(*d*) 30-gramme platinum crucible heat treatment as in official method.

Tests Nos. 7 to 9 inclusive were made in a 30-gramme platinum crucible with a tubulated cover; carbon dioxide being kept passing through during the determination. The heat treatment was exactly the same as in the official method. Both the retort and the crucible tests give results somewhat lower than the official method, though not materially.

SUMMARY.

The results of these experiments may be briefly summarized as follows:—

Two laboratories are likely to vary some 2 per cent. in volatile matter, both using the official method. The percentage of volatile matter obtained from the same sample of coal varies with the temperature and rate of heating. This is not sufficiently defined by the height of the flame. Temperatures ranging from 760° C. to 890° C. may be attained with a 20 cm. natural-gas flame, when the gas pressure is varied from 1 to 13 inches of water; variations of 2 per cent. volatile matter are thus produced. Differences in type and size of burner influence the results from about 0·3 to 1·5 per cent.

Polished crucibles become hotter, and yield about 1 per cent. more volatile matter than dull grey ones.

Laboratories using natural gas are apt to get results on volatile matter that are considerably lower than those using coal gas, unless the following precautions are observed: (1) Gas should be supplied to the burner at a pressure of not less than 10 inches of water. (2) Natural-gas burners admitting an ample supply of air should be used. (3) Gas and air should be regulated so that a flame with a short, well-defined inner cone is produced. (4) The crucibles should be supported on platinum triangles, and kept in well-polished condition.

HIGH-PRESSURE GAS FOR TEXTILE MILLS.

In a previous issue of the "JOURNAL," reference was made to a paper read before the Textile Society of the Manchester School of Technology by Mr. CHARLES WALTON, of Oldham, on the subject of high-pressure gas lighting for textile mills. We have since received from the author the full text of the paper, and make the following extracts from it.

Mr. Walton began by reminding his audience that, though lighting by means of natural gas seemed to have been practised by the Chinese from very early times, its production from coal was not carried out till towards the end of the Seventeenth Century, and then only as a laboratory experiment. A hundred years later, however, William Murdoch invented the present system of gas lighting; and in 1803 he illuminated a portion of the works of Boulton and Watt at Soho, Birmingham. Three years after this, the firm supplied plant for lighting a cotton-mill in Manchester. Since then many improvements of various kinds have been made; but, in the domain of lighting, two stand out conspicuously. The first was making practicable the phenomenon of incandescence, which was the work of Welsbach; and the second was the application of high pressure in the production of intensified lighting. The author pointed out that what is wanted for incandescent lighting is a flame which will impinge on the whole inner surface of the mantle. The first step in high-pressure lighting was in compressing the gas to a pressure of 8 inches of water, whereas it is now worked at 54 inches, or 2 lbs. This increases the velocity of the gas at the jet, and thereby induces a great volume of air to be drawn into and mixed with it in the body of the burner.

Passing on to deal with the chemical constituents of coal gas, the author said that they might be divided into light-giving and heat-giving; and in incandescent lighting it is the latter which are utilized. In intensified lighting, the gas and air are more thoroughly and correctly mixed in various ways to give, with perfect combustion, the maximum heat contained in a gas; and according to the degree of perfection attained in the mixture, a more intense heat can be obtained from a smaller quantity of gas, and the mantle would have a higher incandescence. While with the old-fashioned flat-flame burner the pressure of gas at the tip should be reduced to a minimum in order to get the most light, with the incandescent mantle the conditions are reversed, and it is essential that the pressure should be at least 2 inches of water in order to get a good light. In intensified lighting, the pressure is further increased up to 54 inches with still better results. The author laid stress upon the fact that gas of high illuminating power required by the flat-flame burner is unsuitable for incandescent lighting, as it is far too rich. Its reduction to (say) 10-candle power would, he said, open out immense possibilities in the cheapening of gas; and the sooner flat-flame burners become relics of the past, the better it would be for the gas consumer The gas of the future would be one of low illuminating power, distributed at three or four times the present pressure.

These remarks led the author to consider the question of illumination; and he reminded his audience that mere brilliancy is not the highest property of a light-giving medium—diffusion, or more correctly suffusion, being of greater importance. He illustrated this by comparing the light of the electric arc with that of the incandescent mantle; the former being, he said, brilliant but coldly penetrating, and only very slightly diffusive, whereas the latter seemed to suffuse the air with light, and make luminous all the space within its range. By widening its range, its usefulness was increased. It did not produce violent shadows like the arc light, but distributed the light with remarkable uniformity. It was the object of high-pressure lighting to widen the range of the ordinary incandescent mantle, and thus increase its illuminating value. In the spectrum of the electric arc light, the blue and violet rays predominated, while in that of the incandescent light there was more of the yellow and red, so that it more nearly resembled sunlight. With regard to the hygienic side of the question, the author said that practically, with ordinary incandescent lighting, the hygienic results might be said to equal those of electric lighting; but with intensified light they were better. The atmosphere was purer, owing, in the first place, to the complete combustion of the gas; and, secondly, to the smaller quantity of gas required to produce the same illumination. Of course, there were instances where it was not advisable to burn gas, and where electricity was found to be very useful.

Mr. Walton next described, by the aid of lantern slides, two systems representative of the different classes of intensified lighting which the managers of the particular mill in which all the observations were taken had under consideration after they had decided to adopt high-pressure lighting. These were the Keith system of compressed gas, and the Selas system of compressed

* See "JOURNAL," Vol. LXXXV., p. 89.
† *Ibid.*, Vol. CVIII., p. 184.

air and gas. Having explained the machinery employed in the first-named system, the author passed on to refer to the lamps used in connection with it. One of the slides illustrated the 300-candle and 75-candle burners, both fitted with globes and galleries; also a small flat-flame governor burner which it is sometimes desired to make use of on the high-pressure line of piping as a pilot light when the compressor is stopped, so that the place will not be in total darkness. The burners are adjustable, so that they do not flare up like those of the ordinary type when under pressure. Coming to later lamps and fittings on Keith's system (spoken of as the 1908 patterns), the author showed a rotary compressor which can be arranged for any form of driving—belt, direct-coupled electric motor, or gas-engine. These compressors are generally used at the pressure of a 54-inch column of water, or 2 lbs. per square inch, in order to obtain good results with the new lamps, which are all of the inverted type, and from 60 to 1500 candle power per single burner. These were shown on the screen; and it was stated that the one most suitable for factories is the 100-candle burner. The lamps can be used without globes, with a single globe, or with two globes; but the only way in which a secondary air supply can be properly heated is by the use of two globes—the outer one being without an opening, and the inner one having an opening at the bottom. The result is that by the two glasses an annular space is formed, down which air has to pass for supporting combustion, and is thus heated before reaching the mantle. The author thought that the gain in light was not worth the extra expense and trouble entailed in cleaning for factory purposes, as the accumulation of dust, even after an hour's work, must nullify the gain in light. He gave the following as theoretical comparisons of candle power with and without globes, in a clear atmosphere: No globe, 50; with one globe, 55; with two globes, 60. From experience in textile factory lighting, it is found that the inverted burner meets with approval, from both the proprietors' and the workers' points of view; and burners of about 100-candle power, each suitably arranged, are found of general utility, with burners of from 300 to 500 candle power for the engine-house and yards. The 100 and 120 candle power burners require 2 cubic feet of gas per hour; and with gas at 2s. 6d. per 1000 cubic feet this works out to 0·06d., or 16⅔ burning hours for 1d. To obtain equal illumination from electricity, by the most approved lamp on the market, it would be necessary for current to cost less than ½d. per unit. These remarks were illustrated by views of a spinning-room and a cop-winding room taken by the Keith light.

The author next proceeded to describe the Selas system of lighting, in which the greater portion of the air required for the efficient combustion of the gas is mixed with the gas at the compressor, generally in the proportion of one part of gas and at the utmost two parts of air. It is then passed through the pipes under a pressure of 10 to 12 inches of water. The reason assigned for lamps on this system working so economically with so low a pressure, though the mixture of air and gas is preheated at the lamp, is that the gas and air being already mixed, a greater volume has to pass through the nipple than in the case of compressed gas. Moreover, high velocity is not required to induce a large quantity of air at the burner; and therefore the nipple is made larger, with a consequent reduction of surface friction. Having described the compressing plant, the author said the lamps on this system are made to cover a very large range; a duty of from 50 to 5000 candle power being obtainable from the same general mixing and service pipes. Until recently, the lamps for textile mills were of 80-candle power, without preheaters, and consumed 2 cubic feet of gas per hour. Those with which the audience were specially concerned, however, were the 100-candle power lamps specially constructed for textile use. The author showed first a spinning-lamp, and it was noticeable that there was no shade to it, and very little surface to facilitate the collection of much dust and fluff—thereby reducing the possibility of firing. The points of difference between these lamps and those previously described were indicated; and then a weaving-lamp, having a shade reflector, was shown. Both lamps had globes; but, as the author had previously stated, he did not think any advantage was derived from their use. Another lamp shown was of the same candle power, and suitable for mill yards or other outside illumination; all parts being well protected against weather. One claim made for these lamps is that the consumption is the same, independently of the size—*i.e.*, 0·02 cubic foot per candle power per hour. Consequently, the makers' present standard textile lamp consumes, on an average, 2 cubic feet per hour for 100-candle power. Another claim is that the plant can be fitted to existing piping which will withstand a pressure of 10 to 12 inches of water, whereas with 54-inch pressure new piping is required throughout. The author said he knew of installations where the old piping was being used under both pressures without any trouble; but he thought that it was a risky undertaking, and personally, for high-pressure lighting, he would put in new piping throughout.

Maintenance.

The next subject dealt with was that of maintenance. The author pointed out that one of the most remarkable features of these new lamps is the smallness of the mantle compared with its illuminating power. This is attainable by the concentrated nature of the flame; and it shows that the characteristics of the flame rather than the mantle area are of supreme importance in attaining high efficiencies. The reduction of the mantle to a small size for a large illuminating power lessens the chance of breakage, and consequently decreases the cost of maintenance. The author said the best way to illustrate this would be by giving his actual figures for one year's working.

Mantles.

Pressure	54 in.	10 in.	10 in.	54 in.	
No. of lights	584	64	4	5	Total, 657.
Candle power	100	90	75	300	
Mantles used	740	144	12	12	Total, 908.
,, per light	1·27	2·25	3·0	2·4	Aver., 1·38.
Average price each	3·25d.	4·0d.	3·0d.	4·5d.	Aver., 3 38d.
Cost of renewals	£10 0s. 6d.	£2 8s. 0d.	3s.	4s. 6d.	Total, £12 16s.
Cost per light	4·12d.	9·0d.	9·0d.	10·8d.	Aver., 4·68d.

The 90-candle power lights working at 10-inch pressure have a much larger mantle than the 100-candle lights working at 54-inch pressure; and the increase in mantles per light is remarkable, seeing that they are in similar rooms. It can only be accounted for by the difference in mantle area—the 90-candle power light presenting more surface for destruction. The mantles may either be collodionized or of the soft form, which are much preferred, because the high pressure gas is particularly suitable for shaping each mantle to the flame to which it has to accommodate itself. It is advisable to have a man to put on the mantles and keep the lamps in order; and in lighting hours his sole duty should be to attend to them. It is useless to instal the high-pressure system of gas lighting and expect it to look after itself; for so much depends upon the lamps being always in perfect order. They should be kept so. In all cases there should be entirely new piping. For running the compressor when the main engine is stopped, a small gas-engine is very suitable. It is fairly efficient, and as it will be in close proximity to the meter and compressor, it can be easily arranged for.

We give in full the concluding portion of the paper, in which the author dealt with the subject of the

Cost of Lighting.

First of all we will consider a theoretical comparison of costs, only taking into account the consumption of lighting medium and the candle power obtained. For this purpose, I have worked out various systems on the basis of 1000-candle power (nominal in the case of electricity) for one hour.

Gas.

	Efficiency per Cubic Foot per Hour.	Consumption in Cubic Feet per Hour.	Cost in Pence at 3/-	2/8	2/6
Flat-flame burner	3	333·3	12·00	10·66	10·00
Ordinary incandescent do.	16	62·5	2·25	2·00	1·87
Inverted ,, ,,	20	50·0	1·80	1·60	1·50
Keith's old system	30	33·3	1·20	1·06	1·00
Selas ,, ,,	40	25·0	0·90	0·80	0·75
,, new ,, ,,	50	20·0	0·72	0·64	0·60
Keith's ,, ,, (1908)	60	16·6	0·60	0·53	0·50

Electricity.

	Watts per Hour.	In Watts per Hour.	Cost in Pence at 4d.	3d.	1½d.
Carbon filament lamp	0·25	4000	16	12·00	6·00
Metallic ,, (Tantalums)	0·5	2000	8	6·00	3·00
,, ,, (Osrams)	0·8	1250	5	3·75	1·87

The efficiencies of the electric incandescent lights have been taken at the manufacturers' own rating. The figures for the high-pressure gas-lights have been calculated from what the makers guarantee, and are well within reach. There is, however, a difference between these comparisons and those taken from actual working conditions when all maintenance and sundry expenses are considered. Therefore we will at once pass on to take a particular case.

We will consider first the conditions under which the mill was working before high-pressure lighting was installed. From January to December, 1907, it was entirely lighted by flat-flame burners, 860 in number, which consumed in the year 2,316,600 cubic feet of gas at a cost of £290 18s. The maintenance and depreciation charges on this method of lighting are a negligible quantity; therefore the total cost for the year was the sum stated. The burners were all 15-candle power; giving a total for the installation of (15 × 860) 12,900-candle power. These 15-candle burners are generally supposed to consume 5 cubic feet of gas per hour; and to verify this, and at the same time permit of more accurate calculations in estimating the saving to be made by using the high-pressure system, from figures the makers had given us and guaranteed, 250 flat-flame burners were lit, and the consumption taken for half-an-hour amounted to 562 cubic feet, or 4½ cubic feet per hour per burner. This equals a total consumption per hour for all the lights of (860 × 4½) 3870 cubic feet. But a better figure for comparison is the consumption per candle power, which is 0·3 cubic foot per hour. The cost per hour for the time the lights were in use is 9s. 9d. But here again the figure is not a comparative one. The cost per candle power should be used, which equals 5·41d. per candle power per annum.

It was then decided to employ high-pressure gas for lighting; but before installing the system throughout the mill, experimental plant was put down in one section. It was of the type already described, having a rotary compressor working at from 8 to 10 inches of water pressure. The cost for similar plant for the whole mill is given along with particulars of the consumption, upkeep, and cost per candle power. This installation proved to be a success in accordance with the figures given. Therefore a

complete plant, on the improved system, of 54 inches water pressure was put down. When this was completed, it consisted of—

					Cubic Feet per Hour.
584	lights,	100 c.p.,	consuming 2 cub. ft. per hour	. .	1168
64	,,	90 ,,	,, 3 ,, ,,	. .	192
4	,,	75 ,,	,, 1½ ,, ,,	. .	6
5	,,	300 ,,	,, 5 ,, ,,	. .	25
657					
32	ord. incan. lights	60 ,,	,, 4 ,, ,,	. .	128
67	flat-flame burn's	15 ,,	4½ ,, ,,	. .	302
99					
756 lights, with a calculated consumption of					1821

Thus the 756 burners consisted of 657 intensified lights and 99 ordinary lights which were necessary as pilot-lights and for special purposes.

In the particulars of consumption and costs tabulated, it must be taken into consideration that the compressor is driven from a gas-engine of 2½-H.P., and that the quantity of gas required for running it is included in the quantity used for lighting. The renewal of mantles is taken from the maintenance sheet, and is the actual cost for one year. It will be noticed that the calculated consumption of gas is in each case greater than the actual consumption. The makers' figures are therefore well within reach. The consumption per candle power per hour practically bears out the theoretical calculations already given; but the reduction in cost is not so great (5·41 to 0·812), and is due to interest, depreciation, and renewal charges.

At the time of these alterations, estimates were also obtained for lighting the mill electrically, two systems being considered—(1) using 16-candle power carbon filament lamps, one to each loom; (2) using 50-candle power Osram lamps, one to two looms. Two manufacturers are, to my knowledge, installing electric lights—one using Tantalum lamps, and the other Osrams. The latter is the most efficient on the market, according to the makers' own rating.

Another important point to consider in electric lighting is whether you are going to generate your own current or buy it. In the first case, there is a greater initial cost by requiring generators, &c.; and the running charges include coal and engine-room expenses. But these are more than counterbalanced by the enormous cost of buying current, even when all is obtained at its lowest possible figure—*i.e.*, 1½d. per unit (for this district). The carbon filament lamps being of very low efficiency—*i.e.*, ¼—require considerably more current than Osrams. This means a larger dynamo and increased coal consumption and sundry expenses. The coal consumption is worked out on the basis of 2 lbs. per indicated horse-power-hour.

Using one lamp per loom, 2000 lamps are required, giving a total of 32,000-candle power, which is much poorer than that of the intensified lights—in fact, less than half. In the calculations for the renewals of lamps, each lamp was allowed a life of 2400 hours, which is a high figure, and was charged at 8½d. each.

The results between purchasing and generating current are surprising—being 5·32 and 3·25 respectively. The same method of comparison is used with the Osram lamps. The initial cost is much less, as a smaller generator may be used. There is also less wiring and fewer connections by using a smaller number of lamps of greater power and efficiency. Here one lamp of 50-candle power is used for two looms, so that 860 lamps altogether are required, giving a total of 43,000-candle power. This is much better than that obtained by the carbon filament lamps, but still not so good as the high-pressure light.

For obtaining the cost of renewals, each lamp was, in this case, allowed a life of 1200 hours. This is high, considering the very fragile nature of these lamps. The price per lamp is 3s. 9d. Here again the difference between buying and generating current is great; being 1·83 and 2·16 per candle power per annum. The great difference between carbon and Osram lamps is entirely due to the efficiency and arrangements of the lamps. For instance, to get 32,000 nominal candle power from carbon lamps, 128 units per hour are required, while for Osram lamps only 53·32 units are wanted for 43,000-candle power; or, for correct comparison, 4 watts against 1·24 watts per candle power per hour.

In the cost, 4½ per cent. interest on capital has been allowed; also for depreciation, 7½ per cent. on electricity and 10 per cent. on gas. Coal, mantles, and lamps, also gas and current, are charged at present prices. Allowance is made for gas used in electrically-lit mills for pilots and sundry purposes. The attendance charges, engine-room, and running expenses are from the analysis of a season's working. The cost per hour must not be considered when comparing lights, as it does not take into account the luminosity, but the cost per candle power per year. Thus, taking the three representative classes, we get—

Flat-flame	5·410d.	per candle power	per year.
54-inch high-pressure . .	0·812	,, ,,	,,
Osram (generated current)	1·830	,, ,,	,,

The difference is sufficient, I should think, to entice the most conservative business man.

The reduction in gas consumption in 1909 compared with 1907 is 55 per cent. The actual saving on the flat-flame system, when charging interest on the cost of plant, and allowing full depreciation, is 19·81 per cent.

Conclusion.

In conclusion, I think I am justified in saying that, so far, the

Summary of Costs.

—	Gas.			Electricity.			
				Electric Incandescent Carbon Filament Lamps.		Osram Lamps.	
	Flat-Flame.	High Pressure, 10-Inch Water Gauge.	High Pressure, 54-Inch.	Generating Current.	Buying Current at 1½d. per Unit.	Generating Current.	Buying Current at 1½d. per Unit.
Total initial cost of installation	..	£532	£532	£2300	£1475	£1100	£600
Number of lights and nominal candle power . .	860 × 15	653 × 90 4 × 75 32 × 60 67 × 15	5 × 300 584 × 100 64 × 90 4 × 75 32 × 60 67 × 15 (756)	2000 × 16	2000 × 16	860 × 50	860 × 50
Total nominal candle power	12,900	61,995	68,885	32,000	32,000	43,000	43,000
Horse power required for dynamo or compressor.	..	2½	2½	170	..	75	..
Amount of coal used per I.H.P. per hour . . .	..	Gas	Gas	2 lbs.	..	2	..
Hours lighting per year	598	600	612	600	600	600	600
Renewals of mantles and lamps per year . . .	..	1,400	908	500	500	430	430
Total consumption—							
For the year	2,316,600 c. ft.	1,332,000 c. ft.	1,041,600 c. ft.	..	76,800 units	..	31,992 units
Per hour for all lights (actual)	3,870 ,,	2,220 ,,	1,700 ,,	..	..	..	..
,, ,, ,, (calculated).	..	2,395 ,,	1,821 ,,	..	128 units	..	53·32 units
Per candle power per hour	0 3 ,,	0·0358 ,,	0·0246 ,,	..	4 watts	..	1·24 watts
Interest on capital, 4½ per cent.	..	£23 18 9	£23 18 9	£103 10 0	£66 7 6	£49 10 0	£27 0 0
Depreciation: 7½ per cent. electricity, 10 per cent. gas	..	53 4 0	53 4 0	172 10 0	110 12 6	82 10 0	45 0 0
Coal, at 10s. per ton	..	Driven by gas-engine charged through meter.		45 10 0	..	20 0 0	..
Renewals—Lamps: Carbon, 8½d.; Osrams, 3s. 9d. Mantles.	..	£23 6 8	£12 16 0	17 14 2	17 14 2	80 12 6	80 12 6
Gas at 2s. 8d. per 1000 cubic feet; electricity at 1½d. per unit	£290 18 0	172 12 0	134 16 3	..	480 0 0	..	199 19 0
Including gas used in electrically-lit mills . .	..	..	..	30 0 0	30 0 0	30 0 0	30 0 0
Attendance	..	8 10 0	8 10 0	..	5 0 0	..	5 0 0
Proportion of engine-room wages, &c.	..	..	..	15 0 0	..	15 0 0	..
,, running expenses	..	..	..	50 0 0	..	50 0 0	..
	£290 18 0	£281 11 5	£233 5 0	£434 4 2	£709 14 2	£327 12 6	£387 11 6
Cost per candle power per year (the correct method of comparison)	5·41d.	1·09d.	0·812d.	3·25d.	5·32d.	1·83d.	2·16d.
Total cost per hour worked by light (a sometimes convenient method of comparison)	9s. 9d.	9s. 4d.	7s. 7d.	14s. 6d.	23s. 7d.	10s. 11d.	12s. 11d.

high-pressure gas system is considerably cheaper than any other present form of lighting suitable for textile works, and holds its own in competition. It is efficient, generally reliable, and usually simple. Occasionally, however, it is wise to look round to see how others who are aiming for similar utility and efficiency are developing their ideas.

REINFORCED CONCRETE FOR WATER-WORKS.

At a recent Meeting of the University of Liverpool Engineering Society, the Student President, Mr. HAROLD J. F. GOURLEY, selected this subject for his address.

The author began by saying that the use of reinforced concrete in water-works engineering was quite a recent development in this country, though it had been used in Canada and the United States for a number of years, and had for some time been adopted on the Continent, principally in France and Germany. The question naturally arose, Why are we behind the countries named in taking up the use of reinforced concrete? In the first place, there had been considerable difficulty in obtaining loans to cover the cost of reinforced concrete structures for any reasonable period with the sanction of the Local Government Board; but the fact that in the new War Office and the new General Post Office, London, reinforced concrete was used to a considerable extent, indicated a certain inconsistency in the attitude of the Board. In the second place, there was still a prejudice among some engineers against its use. Of course, it was a comparatively new material, but it had stood many severe tests in other countries; and the precise ground of objection to it was rather hard to find.

While time would not permit of an exhaustive consideration of these objections, it might be mentioned that a number of engineers had made experiments bearing on these points; a common procedure being to embed rods of metal up to (say) 1 inch diameter in small blocks of concrete of varying constitution, and to note the appearance after being embedded for, say, three months—during which time the concrete had been subjected to varying external influences—compared with the original appearance of the metal. The results of these experiments showed that, where the concrete was of a suitable character and the metal well embedded, the results were quite satisfactory. Experiments of this kind would yield more instructive and convincing results if they were carried out on a larger scale over longer periods and under more practical conditions. Numerous experiments had been made to determine the magnitude of the ultimate adhesive stress between metal and concrete for different proportions of the latter and for varying conditions in the surface of the metal. These results had shown that for plain rods an ultimate stress of 650 lbs. per square inch at three months was not exceptional. The value used in design, which varied from 60 to 100 lbs. per square inch with different authorities, gave an ample margin.

Before passing on to point out the advantages claimed for reinforced concrete, the author said the various materials of which it is composed should be considered. The sand should be clean, coarse, and sharp. The presence of clay or loam in sand in any considerable proportion rendered it unfit for use. The shingle or broken stone used must be of a hard, close-grained quality, and perfectly clean. The sand, if any, in this material should be screened out. The stones should be varied in size; but the maximum size allowable depended entirely on the size of the concrete members. In small beams, slabs, and columns, $\frac{3}{4}$ inch might be the maximum diameter; but $1\frac{1}{4}$ or $1\frac{1}{2}$ inches might be allowable in larger members. The stone and sand must always be gauged separately. It was most unscientific and unsatisfactory to go to some trouble to carefully determine the proportions of a concrete, and specify accordingly, and then, as was sometimes done, to allow a mixture of the two to rank as equivalent to the separate gaugings. The cement should fulfil the British standard specification; and for this class of work it must be thoroughly aërated before use in properly constructed sheds. For parts which were subjected to any pressure of water, the proportions of the concrete would be 1 of cement, 2 of sand, and 3 of stone; or, as is the more modern and scientific method of specifying, 770 lbs. of cement, 18 cubic feet of sand, and 27 cubic feet of stone. In other parts, such as the roofs of reservoirs and tanks, a 1 : 2 : 4 mixture was generally used. The mixing should be done in a batch mixer, and after finding the quantity of clean water which gave a rather wet mixture, this quantity should be strictly adhered to afterwards. The aim in concrete making, particularly in reinforced concrete work, should be to get absolute uniformity throughout. The working stress allowable for concrete in compression was about 600 lbs. per square inch for pieces subjected to bending, 500 lbs. in columns, and 60 lbs. in shear.

Regarding the reinforcement, the author remarked that this was now usually mild steel; but when welding was necessary, wrought iron was the safer metal to use. The working tensile stress for steel was about 16,000 lbs. per square inch, and about 11,000 lbs. per square inch for wrought-iron stirrups, joists, or straight or twisted steel bars. As to the amount of reinforcement usually provided in a simple beam, the percentage of the whole area of beam section taken up by the metal would not greatly exceed 1 per cent. on the tension side. Anything above 1 per cent. was usually provided for by using metal in the upper portion of the beam, which was not economical, since such extra metal could carry only about half the working stress of the metal in tension. A slight rust film on the metal was not objectionable—in fact, it was an advantage; but any loose scale, rust, or oil should be removed, as it tended to destroy the adhesion between the metal and the surrounding concrete. As regards the amount of cover necessary, some authorities gave a minimum of $\frac{1}{2}$ inch; but this evidently referred to beams and the like. Probably for water-works structures (particularly those actually in contact with water), the minimum would be 1 inch to $1\frac{1}{2}$ inches.

Coming to the advantages of using reinforced concrete in reservoirs, tanks, and filter-beds, the author said they were as follows: (*a*) It was more economical. The roofs, walls, and floors were very much lighter than if built in concrete or masonry. For reservoir bottoms in bad ground, it was much more reliable and less costly than the ordinary methods of construction. The cost of a reservoir built entirely of reinforced concrete was 14 to 15 per cent. cheaper, on an average, than one of equal capacity built of mass concrete or brick or of a combination of both. (*b*) The cost of maintenance was practically *nil*. This was also true of an all-concrete structure. (*c*) Works in reinforced concrete could be constructed very rapidly, due to the simple character of the materials employed. In this very rapidity lay the possible danger of giving too much attention to "speeding-up" the work, and too little to efficient supervision. (*d*) It was generally conceded that reinforced concrete had a high hygienic value. (*e*) By employing reinforced concrete in a reservoir, very much less material was used, and consequently less space occupied. (*f*) The reservoir increased in strength with age. This was an important consideration. Other materials deteriorated, while concrete increased in strength with age. (*g*) A reservoir built of concrete or reinforced concrete throughout, or a combination of both, had no joints; and repairs were readily made if required. As in all other branches of engineering, great care had to be taken in designing the various structures so that they were strong enough to stand all the possible conditions of loading.

The advantages mentioned regarding reservoirs applied equally well to aqueducts. Reinforced concrete conduits also had this advantage over concrete or masonry structures, that they could be, and they had been, subjected to internal pressure due to water under a head. Before expanded steel was used as a reinforcement in certain portions of the Birmingham aqueduct, the engineer had a series of tests made on 4 to 1 concrete slabs, 6 inches thick. Without the expanded steel, the uniformly distributed breaking load was 4 cwt. per square foot, and when reinforced with expanded steel, 3-inch mesh, $\frac{1}{4}$ in. by $\frac{3}{16}$ in. strands, the load was 20 cwt. per square foot. This showed marked advantage due to the reinforcement. Reinforced concrete had also been found suitable for high-pressure water-mains; and it was likely to be largely used for this purpose in the future, particularly as no corrosion could take place in such pipes, whereas in cast-iron pipes and steel tubes this was a serious matter.

For heads up to 40 or 50 feet, reinforced concrete dams had been used to a large extent in the United States, particularly for power schemes. There was one under construction there having a height of about 140 feet; and three or four others of similar magnitude were just about to be built. Among some of the advantages possessed by this type of dam, the author mentioned the following: (*a*) There was practically no danger that the dam would be swept down stream, and absolutely no possibility of the dam being overturned. (*b*) The hydrostatic pressure, acting up, which reduced the stability of a solid masonry dam, was totally absent. (*c*) The strength increased with age. (*d*) The time required for construction was considerably less than for other methods. (*e*) The crushing strength of massive masonry was a somewhat uncertain quantity, and therefore low unit values were adopted for working stresses whenever crushing strength became a factor in the design. In the case of the reinforced concrete structure, the stresses on every part of the structure were quite definite; and the engineer could not only tell exactly how much stress would be found in each part, but could also design the work with any desired factor of safety.

The Late Mr. Trewby's Estate.—Mr. George Careless Trewby, whose death on the 19th ult., at the age of 71, was recorded in the "JOURNAL" the following Tuesday, left estate of the gross value of £120,118; the net personalty being £110,253.

Mine and Quarry Statistics.—A Blue-Book containing Part I. of the general report of the Chief Inspector of Mines for 1909 was issued a short time since. The volume deals with district statistics; and it will be followed by separate parts dealing with labour, output, and foreign and colonial statistics. The total output at the mines under the Coal Mines Act was 277,906,059 tons, of which 263,758,562 tons were coal, 2,695,861 tons fire-clay, 8,039,441 tons ironstone, 2,966,937 tons oil shale, and 445,258 tons sundry minerals. Adding 15,750 tons from open quarries, the total output of coal was 263,774,312 tons, an increase of 2,245,517 tons on the preceding year. The average output of minerals at mines under the Coal Mines Act was 340 tons per person employed underground—a decrease of 6 tons. The total output of minerals at the mines under the Metalliferous Mines Act was 3,095,780 tons, of which 1,674,643 tons were iron ore. The total output from the quarries under the Quarries Act was 44,614,931 tons, of which 4,682,253 tons were iron ore. Including 583,642 tons obtained from shallow open workings, the total output of iron ore was 14,979,979 tons.

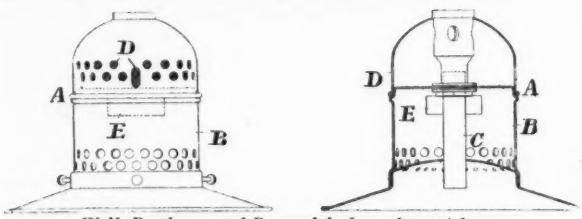
REGISTER OF PATENTS.

Incandescent Gas-Lamps.

WOLF, O., BAMBURY, N. F., and BERNARDY, E., of Bradford.

No. 17,194; July 23, 1909.

According to this invention, the lamp-burner is constructed so that the air is superheated before being mixed with the gas, and the air inlets are disposed in such relationship to the outlets for the products of combustion that the air supply is prevented from being vitiated.



Wolf, Bambury, and Bernardy's Incandescent Lamp.

The two chambers may either be formed separately as shown, and attached by screws, or they may be formed integrally. In either case they are separated one from the other by a plate A, composed of heat-conducting material. The partition is integral with the walls of the lower chamber B; and the bunsen tube is preferably made in two parts, the upper part of which screws on to the lower part, where it protrudes through the partition. This construction also provides means for securing the two chambers together; the upper chamber being clamped between an enlargement on the top of the bunsen tube and the lower chamber. A gas-tight joint is formed at the centre on each side of the partition by asbestos washers. The upper compartment constitutes the chamber wherein the air supply to the burner is superheated prior to being admitted into the bunsen tube C to mix with the gas. The air-admission openings D in the upper chamber are disposed so as to be on the opposite side of the lamp body to the emission openings E in the lower chamber; or if a plurality of openings are round the two chambers, then the air-inlet openings will be disposed so as to be intermediate of the emission openings.

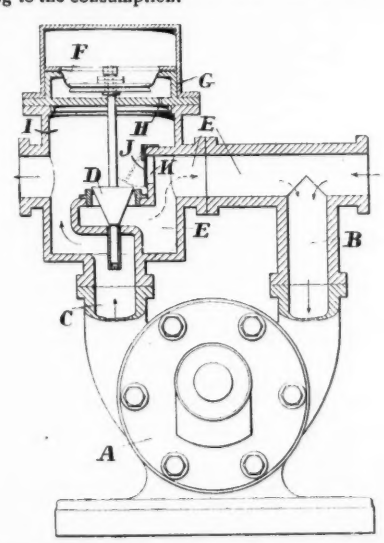
When the lamp is in use, the heat from the products of combustion is transmitted through the partition A to the upper chamber, thereby superheating the air therein before it passes into the bunsen tube to mix with the gas. By means of the two chambers, the air supply is kept entirely separate from the burnt gases; but at the same time it is heated thereby, and consequently, after mixing with the gas in the usual way, it produces a "better burning mixture."

Supplying Gas under Pressure for Illuminating Purposes.

WOLF, O., BAMBURY, N. F., and BERNARDY, E., of Bradford.

No. 17,195; July 23, 1909.

This invention relates to the supply of gas under pressure to be employed for illuminating or like purposes; and it has reference to apparatus which comprises a compressor or pump arranged to supply gas from the main through a pressure-regulating valve to the service-pipe of a lighting or similar installation. The pressure-regulating valve is in the form of an excess-pressure valve, and is automatically operated by the pressure of the gas in the service-pipe to regulate the supply of gas according to the consumption.



Wolf, Bambury, and Bernardy's High-Pressure Lamp Plant.

The usual portion of the apparatus comprises a rotary compressor or pump A driven in any suitable manner. B is the inlet and C the outlet—in direct communication respectively with the gas-main and with the service-pipe of the installation. On the outlet side of the compressor is a valve D, which opens and closes a circulating conduit or passage E between the outlet and inlet. The valve is connected to a diaphragm F within a chamber G, and a passage H forms a communication between the chamber and the interior of the valve casing I; so that the diaphragm is submitted to, and acted upon by, the pressure of the gas in the main.

The compressor runs at a constant speed and normally the valve D remains closed and the gas from the main takes a course indicated by the full-line arrows—*i.e.*, direct into the inlet B, through the compressor, out at the outlet C, and then direct into the service-pipe. When an increase of pressure occurs in the service-pipe, the diaphragm F is raised and opens the valve D, so as to allow gas coming from the outlet to pass through the passage E, as indicated by the dotted-line arrows, back to the inlet. This excess of gas is thus allowed to circulate through the compressor, instead of being forced into the service-pipe; and the compressor draws gas from its outlet side instead of from the main. When the excess pressure in the service-pipe falls, the valve D is closed, and the normal supply of gas is continued.

The automatic bye-pass or supplementary valve for supplying gas to the installation when the apparatus ceases to operate as mentioned, consists of a hinged flap J, located in the valve casing I of the excess pressure valve so as to communicate between the service-pipe and the inlet of the compressor or the gas-main. The flap is loosely pivoted so that it may swing outwards to uncover the opening K, as in the dotted lines. The flap is arranged so that it will close by its own weight and afterwards be kept closed by the influence of increased pressure in the service-pipe when the compressor is in operation. But upon the cessation of the latter and the consequent reduction of the pressure in the service-pipe, the ordinary pressure in the gas-main will open the flap—swing it away from the opening K—so as to uncover the latter, and the gas will then pass through the passage E, opening K, and valve casing I, to the service-pipe, so that the installation will be supplied with gas at the ordinary gas-main pressure until the compressor is restarted.

Mouthpieces of Gas-Retorts.

HELPS, J. W., and PATEMAN, J. W., of Croydon.

No. 18,260; Aug. 7, 1909.

This invention has for its object to provide improved means for supporting and securing the hinge and fastening device of the retort-lid, whereby it may be readily opened and closed, "even when the parts are worn through long service."

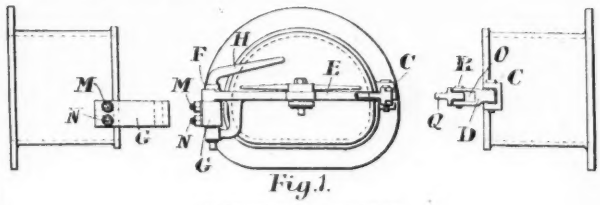
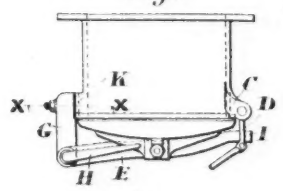


Fig. 1.



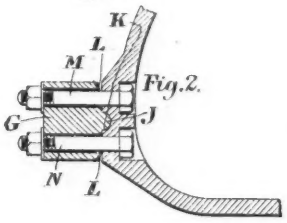


Fig. 2.

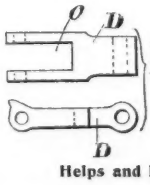


Fig. 3.

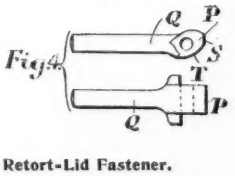


Fig. 4.

Helps and Pateman's Retort-Lid Fastener.

The illustration shows the preferred embodiment of the invention, as applied to a retort mouthpiece and closure of the Morton type. Fig. 1. is a front elevation (also plan and side elevations) of the mouthpiece with the lid or closure in its closed position. Fig. 2 is a section, on an enlarged scale, taken on the line X of fig. 1. Fig. 3 shows the hinged fastening member in plan and elevation. Fig. 4 shows the eccentric member in plan and elevation, which forms the end of the slot in the hinged fastening member.

The mouthpiece is in the form of a D-shaped iron casting, having the usual lid and an integral lug C, in which is pivoted a hinged fastening member D. Attached to the lid is a cross-piece E, pivoted upon an eccentric pin F in the lug G—the pin having a handle H, by which it may be rotated. The end I of the cross-piece remote from the pin is adapted to be engaged by the member D when it is desired to close the mouthpiece; the lid being finally brought firmly against the face of the mouthpiece by rotating the pin.

According to the present invention, the lug G is adjustably secured to the mouthpiece so as to permit of the ready vertical adjustment of the lid. The lug is provided upon one side with a half-round projection J, which fits into a recess K of corresponding shape in the side of the mouthpiece—forming a kind of knuckle or cup joint. The portions of the face of the lug upon each side of the projection are bevelled off as L. In order to secure the lug in place, the two bolts M N are provided, extending through the lug and wall of the mouthpiece above and below the projection J.

The engaging surfaces of the hinged connection between the lug and the cross-piece, of course, tend to wear during use; and this causes the end I of the cross-piece to drop—rendering it difficult to swing the fastener D around the end of the cross-piece. To rectify this, all that is necessary is to slightly slack back the nut on the bolt M and tighten up the nut on the bolt N. This causes the projection J to rotate slightly in the recess K in a counter-clockwise direction (looking at fig. 2), with a consequent lifting of the end I of the cross-piece.

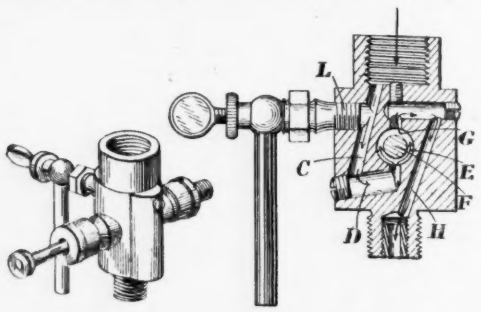
In order to allow of the member D being readily engaged with the end I of the cross-piece, the outer end of the slot O, instead of being closed by an end-piece integral with the member, is formed by the cam end P of a lever Q, which is pivoted by a pin R in the end of the fastening member. It will be seen by fig. 4 that the portion S of the end P of the lever Q is at a greater distance from the centre of the pivot hole than is the portion T. Consequently, if the lever is turned so that this portion forms the end of the slot O in the fastening member, the length of the slot will be substantially greater than if the lever is turned so that the portion forms the end of the slot. By providing these means for varying the length of the slot in the fastening member, the fastening of the lid is facilitated, for the fastening member may be engaged with the slot when the latter is opened to its greatest extent—the aperture being reduced by rotating the lever Q before the final closing of the lid is effected.

Controlling a Gas-Conduit.

EDWARDS, A. N., of Farringdon Street, E.C.

No. 18,435; Aug. 10, 1909.

This apparatus for controlling a conduit for gas or other fluid, by a piston valve acting under fluid pressure, has particular reference to the type of fitting described in patent No. 23,759 of 1906.



Edwards's Inverted Burner Pressure Controller.

The illustration gives a perspective view of the apparatus, and a sectional view to a larger scale.

The valve-casing is provided with an internally screwed inlet, leading from which is a conduit C, which has an angular bend communicating with a second conduit D, which, in turn, communicates with a chamber E, placed cross-wise of the main portion and wherein is a piston F. From the chamber E, the gas travels through conduits G and H to the outlet which communicates with the burner. The piston has a groove in it which registers with small conduits opening into the main conduits G and D. It also has an extension, which is carried through a small cap or nipple screwed on to one end of the chamber E. The other end of the chamber is provided with a cap or nipple adapted to receive the supply pipe from the source of pressure or suction for operating the piston F. Communicating with the conduit C is an orifice L, adapted to receive a bye-pass arm M (provided with an adjustable screw) and lock nut to control the amount of gas flowing through the bye-pass.

Gas, on entering the valve, exerts a pressure on the piston F, the weight of which, however, acting against the pressure of the gas, prevents any escape of gas between the piston and the sides of the chamber E when it is in position to close the conduits. Upon the piston, however, being sucked or forced inwards, gas flows into the chamber G, and thence, by the chamber H and outlet, to the burner.

Utilization of Materials Employed for Purifying Illuminating Gas.

SIMONIN, H., of Pierrefitte (Seine), France.

No. 25,360; Nov. 3, 1909. Date claimed under International Convention, Nov. 5, 1908.

This invention relates to the extraction of the sulphur contained in gas-purifying materials and the transformation of the insoluble nitrogen into soluble nitrogen.

In processes from obtaining products from spent oxide of iron, the patentee points out, the sulphur has been extracted by sulphide of carbon, naphtha, benzol, turpentine, and mineral oils; but he claims to have discovered that, though some of these solvents (together with chloroform and ether) may be used for this purpose in the present process, it is preferable by far to use tetra-chloride of carbon (which is also known for extracting the sulphur) for the reasons hereafter set forth. Bisulphide of carbon has also been proposed to be used for extracting the sulphur; but it is quite impossible to employ this under pressure in such a manner as to produce a vapour tension, in view of the fact that the tension of the vapours of carbon bisulphide is so high that the risk of explosion is great, since an explosive mixture is formed on these vapours being mixed with air. It is therefore essential that the sulphur may be dissolved under tension or pressure of vapours of the solvent in such a manner that the solvent may penetrate (equally and intimately) every part of the mass in spite of the humidity of the vapour. To effect this, he preferably makes use of tetra-chloride of carbon "which is possessed of an extremely low vapour tension and offers no risk of explosion or fire; this substance being non-inflammable and non-explosive when combined with air."

In order to obtain a practical result, the sulphur is dissolved in digesters maintained at a pressure of between 2 and 3 kilos per square centimetre in order to increase the solution coefficient of the sulphur and to limit the quantity of the solvents required. The method of employing a solvent under pressure for dissolving the sulphur constitutes a feature of the invention. Tetra-chloride is, as already pointed out, particularly appropriate for this treatment by reason of the low tension of the vapours and of its oxidizing action; the latter being useful for assisting in the subsequent conversion of the nitrogen. The extraction of the sulphur having been effected, the material is then subjected to an oxidizing action by means of water vapour acting at a pressure of from 2 to 3 kilos per square centimetre for a time sufficient to produce the transformation of the insoluble nitrogen into soluble nitrogen. This period varies between two and three hours. The mixture treated by steam is composed of iron protoxide, cyanides, and carbonate of ammonia. The oxidation is effected by causing steam to pass over this mixture so that the oxygen of the steam becomes fixed upon the protoxide of iron so as to convert it into oxide of iron. The free hydrogen becomes partly fixed on the cyanide of calcium contained in the "crude ammonia" and forms ammonia.

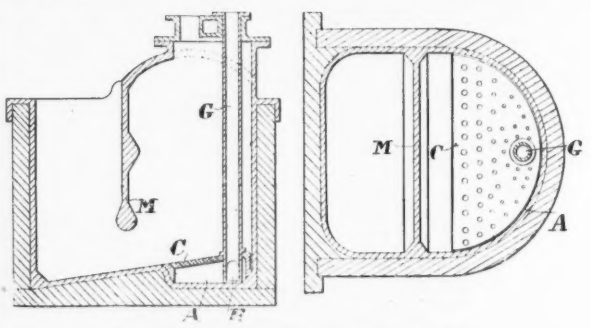
The material thus treated is then mixed with hydrated lime in suitable proportion (determined in accordance with the proportion of nitrogen) and distilled by a dry process or otherwise, or in retorts or in suitable furnaces for producing the liberation of the ammonia; this step of distillation with hydrated lime having already been proposed in a somewhat similar process for converting cyanogen compounds into ammonia. The ammoniacal gas may be collected in the form of an ammoniacal solution or of ammoniacal salts.

Sulphate of Ammonia Saturator.

PETTIGREW, G., of Thornaby-on-Tees.

No. 25,460; Nov. 4, 1909.

According to this invention, a pocket A is formed in the inclined bottom of the saturator which, with a top plate C, forms a "cracker-box," the top plate of which, over its entire surface, is covered with perforations, which increase in area as they recede from the ammonia gas inlet E, so as to ensure the equal distribution of the gas throughout the top surface of it. Through the manhole cover of the saturator pass the inlet pipe G for the ammonia gas as well as the inlet pipe for the acid supply; the pipe G extending through the saturator and through a hole in the "cracker-box" and coming to rest on the bottom of the saturator—thus ensuring proper support for the pipe. An opening is also provided in the manhole cover for the outlet of the waste gas.



Pettigrew's Sulphate of Ammonia Saturator.

The box A is made of acid-proof material, separated from the body of the saturator so as to enable it to be removed through the manhole or under the "apron" or "midfeather" M of the saturator for cleaning or other purposes.

In use, the ammonia gases pass down the inlet pipe into the "cracker-box," and thence through the perforated top into the liquid within the saturator; "being evenly distributed throughout the liquid under all variations of pressure in the gas inlets."

Water-Gas Apparatus.

GLASGOW, A. G., of Victoria Street, Westminster.

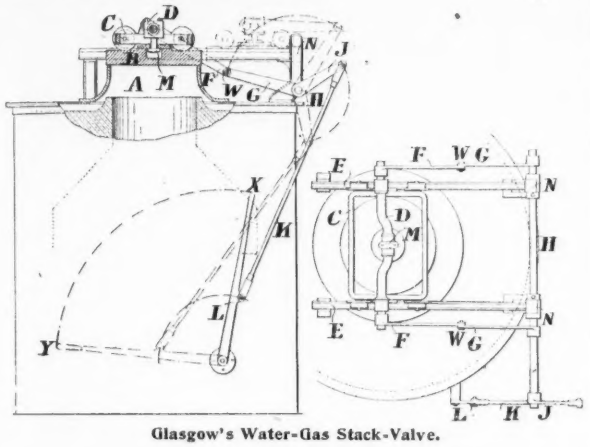
No. 25,474; Nov. 4, 1909.

This invention has for its prime object to facilitate the manipulation of the stack-valve, which is open while blasting to allow the escape of the blast products to the atmosphere, and closed during the process of gas-making. The improved valve (which has sufficient weight to overcome the normal gas pressure, and is free to act as a relief-valve for excessive gas pressure) "is provided with manipulative means which first lift the valve just off its seat and then move it sideways clear of the opening, giving powerful mechanical advantage for the slight lift and suitably reduced mechanical advantage with accelerated speed for the long side movement."

The illustration shows, in plan and elevation (partly in section), the

top of the superheater of the carburetted water-gas plant equipped with a stack-valve according to this invention.

A is the blast products outlet; its upper rim forming the seat upon which the movable valve lid B rests when in its closed position. C is a frame and carriage from which the lid B is suspended by the crank-shaft D. The wheels of the carriage travel along the track formed by the rails E. The lid is suspended from the crank of the shaft, so that the full weight of the lid when closed bears evenly upon the valve-seat; and when the crank-shaft revolves in the direction indicated by the arrow, the lid is lifted off the valve-seat. To the ends of the crank-shaft are fitted levers F, which are, in turn, pin-jointed (at W) with the levers G keyed to the shaft H, which is actuated by hand through the lever J, link K, and lever L.



Glasgow's Water-Gas Stack-Valve.

The single movement of the hand lever L from X to Y first lifts the lid off its seat, and then rolls the carriage along the rails to the dotted position shown; thus leaving the opening quite free for the escape of the blast products. The first angular movement of shaft H and lever G (starting with the valve closed) turns the crank-shaft D and slightly lifts the lid without transmitting any appreciable movement to the carriage; so that during this time the whole effort of the operator is given to lifting the lid a very small distance. But as the revolution of the shaft H proceeds, its turning effect on the shaft D soon diminishes to *nil*, and its angular movement is utilized in pulling the carriage and lid along the rails until checked by the stops N, when it is in full-open position as shown in dotted lines. The hand lever L further increases the mechanical advantage for lifting.

With horizontal rails, the opening lid ceases to exert any further closing effect against the hand lever after it has reached its maximum lift; and its weight then tends to complete the stroke. By varying the grade of the rails from the horizontal, the effort curve of the hand lever can be modified accordingly.

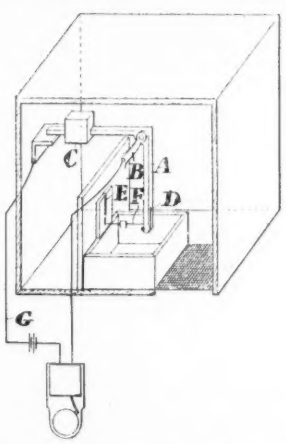
The lid is suspended from the stud M in such a manner that it has some play vertically, and is, to this extent, free to lift from its seat to relieve any excess gas pressure. Should further relief be necessary, the combined lid and carriage is free to lift and turn about the pin-joints W, without having to give any motion to the system of levers.

Preventing Gas Explosions and Poisoning.

PAUSINGER, F. VON, of Carinthia, Austria.

No. 774; Jan. 11, 1910. Date claimed under International Convention, Jan. 11, 1909.

This invention relates to an alarm apparatus of the type in which the contact of a current circuit is held open against the action of a spring or weight by a thread provided with a pill of spongy platinum. Its object is to increase the sensitiveness of the apparatus and prevent



Von Pausinger's Gas-Escape Alarm Apparatus.

explosions due to the formation of sparks during their operation. This is essentially secured by employing a thread of easily fusible material—for example, Wood's alloy—for holding the contact open; so that, with the least warming of the platinum sponge, the thread is melted, and the arrangement is thus brought into operation.

The apparatus as illustrated is enclosed in a box. It comprises a right-angled contact lever A mounted to oscillate upon a partition arranged in the box, as upon an arm B. One end of the arm of the contact lever is loaded by a spring or by a weight C, and is adjacent to an angular contact piece upon one wall of the box. Between the end D of the vertical arm of the lever and a slotted plate E on the partition is stretched a thread F of fusible metal, carrying a pill of spongy platinum, so that the free end of the contact lever is lifted above the upper contact piece. Beneath the stretched metal thread is a receptacle filled with liquid (preferably glycerine), and covered by a thin paraffin membrane, into which the heated platinum sponge pill falls after melting of the metal thread, whereby ignition of the gas in the box is prevented.

For permitting the entry of gas to the box, one or more walls of it are formed of fine-mesh wire net or gauze preventing the spread of ignited gas to the exterior, or one wall, or (as shown) the floor may be alone provided with a gauze window, in which latter case the advantage is secured of protecting the apparatus against dust.

If gas is admitted to the platinum sponge pill through the window—and particularly in the application of the apparatus to illuminating gas, water gas, &c.—issuing into an enclosed space, the platinum sponge heats and melts the metal thread. The contact lever is therefore liberated, and falls under the action of the weight upon the upper contact piece, closing an electric circuit G, so that the alarm bell connected to it is sounded.

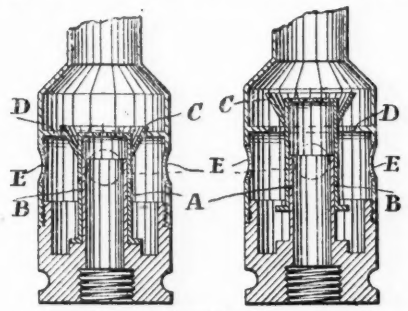
Bunsen Burner for Illuminating Purposes.

MEYER-ZIMMERLI, E., of Zurich, Switzerland.

No. 830; Jan. 12, 1910. Date claimed under International Convention, Jan. 19, 1909.

This invention consists in providing the body of the gas-nozzle of the bunsen with a cap, which, as the pressure of the gas rises, is lifted more and more from a contracted opening in the mixing-pipe and situated above the point of admission of the air, thereby enlarging the cross sectional area of the passage for the air.

The two figures show the burner with the parts in two positions.



Meyer-Zimmerli Regulator Bunsen Burner.

The burner-nipple is formed with a gas-inlet A, on which is placed a movable gas-nozzle B. The head of the nozzle contains the outlet openings for the gas, and carries an inverted conical collar C. When the gas is cut off, the nozzle is in its lower position, and the edge of the collar thereupon closes the contracted opening D provided in a mixing pipe, which surrounds the gas-nozzle body—the mixing-pipe being screwed in the nipple. The mixing-pipe has openings E underneath the opening D for admitting air. When gas is admitted into the nozzle, the gas pressure raises the nozzle body into the second position shown. The collar C moves away from the opening, and the cross sectional area for admitting the air is increased.

If the cross sectional area for admitting the air is again contracted, by a further rise of the nozzle, in consequence of the contraction of the mixing-pipe, the cross sectional enlargement corresponding to the rise in pressure is only possible for a short distance above the first position shown, after which the cross section remains the same for a distance and is then again reduced. If the pressure of the gas is diminished, the nozzle settles down, and the edge of the collar comes over the contraction of the mixing-pipe. The cross section is in this way decreased in the same relation as the quantity of gas flowing out is decreased, through the decrease in pressure.

Constant-Emission Gas-Calorimeters, &c.

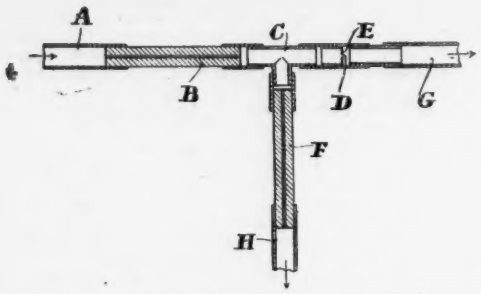
FAHRENHEIM, H., of Essen-an-der-Ruhr, Germany.

No. 3641; Feb. 14, 1910.

In apparatus used for the discharge or emission of constant streams of gaseous matter, the patentee points out, capillary tubes are in some cases used for the purpose of rendering the rate of discharge more or less independent of changes of specific weight. To secure complete independence, the ratio of the length to the diameter of the tube would have to be infinitely great. In practice, therefore, the influence of specific gravity is never entirely obviated by the means referred to—more particularly in apparatus used for delivering predetermined quantities of gas per unit of time, as in certain calorimeters. In most cases, the gas is only slightly above normal atmospheric pressure; so that the ratio of length and diameter of the tube must be very far from the ideal indicated. It has been established by careful tests that, under these conditions, there is actual dependence between the rate of emission and the specific weight of the gas; the dependence being linear in the sense that, with decreasing specific weight, the velocity of the gas in the tube increases.

The object of the present invention is to provide apparatus which

"enables considerable, practically uniform, quantities of gas to be discharged per unit of time, independently of changes of weight." Substantially, the invention consists in using, in parallel with a capillary tube of adequate dimensions, a small orifice in a thin wall, through which gas is discharged into the atmosphere; the gas issuing from the tube being alone used for the measurement, test, or other purpose for which a constant gas-supply is required.



Fahrenheim's Uniform Gas Discharger for Calorimeters.

The theory of the combination described is as follows: Under normal constant conditions, the rates of flow through the tube and hole respectively bear a definite, constant relation to each other. This relation is, however, at once upset if the conditions change. This is due to the fact that the rate of flow through the tube is subject to linear variation; whereas the rate of flow through the small orifice in the thin wall is subject to quadratic variation. With constant gas pressure, the square of the velocity of emission from the hole in the wall is inversely proportional to the specific weight of the gas. It follows that, with decreasing specific weight, the velocity of the gas flowing through the hole increases in quadratic progression. On the other hand, the velocity in the tube undergoes only linear variation; so that the quantitative change due to change of weight occurs mainly at the hole. In other words, if the passage afforded by the hole were not available, the total effect of change of weight would be evidenced in a quantitative change in the emission by the tube, whereas the provision of the hole causes the greater part of the change to be transferred to the hole. The change in the rate of delivery of the tube is then practically negligible.

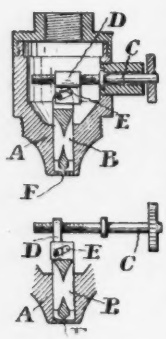
A construction embodying the combination described is shown in the accompanying section. A represents a conduit through which the gas flows from a pressure regulator to a capillary tube B, and thence into a chamber C. The latter has a minute discharge orifice D in a thin wall E; and a second parallel discharge is afforded by a capillary tube F. The gas issuing from the orifice D is led by a pipe G into the atmosphere—preferably through a chimney; while the gas issuing from the tube F is led by a pipe H to the apparatus or instrument in which it is required—for example, a calorimeter or analytical appliance.

Regulating Device for Bunsen Burners.

HIRSCHHORN, J., of Berlin.

No. 2528; Feb. 1, 1910. Date claimed under International Convention, Feb. 16, 1909.

The object of this invention is to provide means for moving the valve of a bunsen burner by turning the spindle, so that the adjustment can be very accurately performed, and the risk of binding reduced to a minimum.



Hirschhorn's Bunsen Regulator.

Two constructions embodying the improvement are shown. In the first (A representing the nozzle, and B the valve), a spindle C has bearing in a sleeve fixed to the wall of the nozzle-chamber, and is screw-threaded within the chamber, in which it carries a screw-threaded rider D having a depending lug. This lug has an inclined groove or slot E engaged by a pin fixed to the valve. Inasmuch as the rider, thus engaged, cannot rotate on the spindle, it is moved to the right or left by rotating the spindle; and inasmuch as the valve cannot move to the right or left, it is compelled by the slot E to move downwards or upwards, to and from the gas-orifice F, during the movement of the rider. In the second arrangement, the valve B has a lug provided with a slot E, and the latter is engaged by a pin fixed to the rider D.

Other modifications are possible. For instance, the spindle itself may be longitudinally movable, by working in a screw-threaded bearing; the rider being in this case either axially immovable relatively to the spindle or engaged with the latter by a thread oppositely directed to the thread of the bearing.

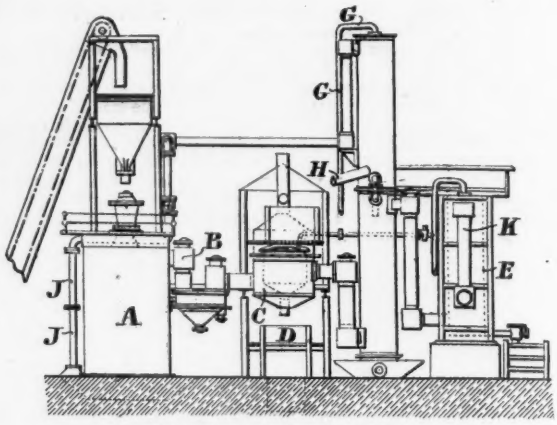
Recovery of Ammonia from Producer Gas.

DUFF, A. B., of Pittsburg, U.S.A., and the GAS POWER AND BYE-PRODUCTS COMPANY, LIMITED, of Glasgow.

No. 4372; Feb. 22, 1910.

This invention has for its object to improve the process and simplify the apparatus used in the recovery of ammonia from producer gas.

As shown, the gas-producers (of which only one, A, is shown) are fed with fuel as usual by a central hopper, charged when required from an overhead hopper to which the fuel is raised by the usual elevator. The gas generated on leaving the producer passes, by a pipe B, into the usual collecting and dust-separating main. From the main the gas is led to the interior of a casing C surrounding a boiling-down pan, of usual construction—that is, it is fitted with an overhead vapour collecting canopy and vapour discharge pipe, and a valve controlled outlet through which the crystals and liquor formed are discharged to a drainer D, beneath which is the usual liquor well. By means of a valve controlled pipe, circulation is kept up in the ammonia recovery tower E (as hereafter described), so that the weak "sulphate liquor," produced in the tower in the usual manner, may pass, when required, to the boiling-down pan. Only a small amount of the heat in the gas within the casing C is required to expeditiously boil down this liquor; so that the gas leaves the casing still having a considerable portion of its sensible heat. From the casing C, the gas passes by a pipe connection to, and enters, the bottom of a gas washing and heat exchanging tower (of any known form). Water is admitted to the top of the tower and falls through it, so that the water is brought into intimate contact with the ascending gases, and as the heat in the gas is ample for the purpose, the temperature of the water is raised to, or near to, boiling point; and at the same time the water washes out the dust and a portion of the tars which the gas held in a fluid condition. On reaching the bottom of the tower, the water and tars fall into a tank luting the bottom of the tower; and the water is drawn from this tank by a pump (not shown) and forced up a pipe G to the top of a second tower placed above the gas-washing tower—the water entering this tower through some form of spray device on its upper end and leaving the bottom through a pipe connection, communicating through a spray device with the interior of the lower tower at the top of the latter. The upper tower is of "any known heat exchanging type."



Duff's Ammonia-Recovery Plant.

Air from a blower (not shown) enters the bottom of the upper tower through a pipe H; and, as the air and the boiling water pass through this upper tower in opposite directions, not only is the air highly heated, but a very large amount of the steam required in the producer passes off with the heated air. The end of the pipe connections next the producer is fitted with a regulating valve, and enters what may be termed a false top, or enclosed space, formed in the top of the producer, so that advantage may be taken of the great heat at this part of the producer to superheat the mixture of air and steam. From the enclosed space the air and steam are led by a pipe J communicating, as usual, with the interior of the producer.

As described, the water, after parting with most of its heat and steam to the air passing through the upper tower, passes into the gas-washing tower, and is there reheated to or near the boiling point and again forced by the pump, through the pipe G, to the upper end of the upper tower; the circulation thus being continuous.

When the gas leaves the washing tower, its temperature is sufficiently reduced to permit of it being treated in the ordinary ammonia-recovery tower; and from the gas-washing tower the gas passes to the bottom of the ammonia-recovery tower E, where it is treated in the usual way with a weak sulphuric acid solution to produce the weak sulphate of ammonia—the solution being kept in circulation by a pump (not shown) drawing the liquid from an acid tank and forcing it to the top of the ammonia-recovery tower E. From this tower the gas passes through the usual main K either direct to a receiver or through mechanical washing plant of any desired form, depending on the use to which it is to be put.

It is to be understood, the patentees point out, that the various steps in the process and the various parts of the plant described are known separately, and that they make no claim to each individual step or part by itself.

Gas Supply in Cork.—Compared with the first half of the past year, the accounts presented at the ordinary general meeting of the Cork Gas Consumers' Company last Thursday showed a small increase in the consumption of gas in the six months ended the 30th of June, and a good return of residuals on the quantity of coal carbonized. The Directors in their report remarked that an increasing source of revenue was the extended use of gas for cooking and heating purposes; and that the consumption of gas on the slot-meter system was satisfactory. The balance of profit and loss was £6007, out of which the Directors proposed to pay a dividend at the rate of 8 per cent. per annum. This would amount to £5507, and leave £500 to be added to the reserve fund. The Chairman (Mr. George Lynch) pointed out that the consumers now numbered 9239, an increase of 388 over the previous year; while the demand for cooking and heating appliances continued. With regard to lighting, it was becoming more and more apparent that gas was more than able to hold its own in the competition it had to contend against by electricity.

LEGAL INTELLIGENCE.

RIVAL POWER-GAS PATENTS.

Lord Ardwall, on Wednesday last, in the Bill Chamber of the Court of Session at Edinburgh, disposed of an application made by the Gas Power and Bye-Products Company, Limited, of No. 116, Hope Street, Glasgow, to have Messrs. Wm. Beardmore and Co., Limited, of No. 36, Victoria Street, Westminster, carrying on business at Parkhead Forge, Glasgow, and elsewhere in Scotland, interdicted from permitting the Power Gas Corporation, Limited, of No. 39, Victoria Street, S.W., and their representatives or experts, to inspect the details and construction of gas producers and ammonia recovery plant erected by Messrs. Beardmore as licensees of the complainers. By contract entered into in October, 1904, the complainers granted a licence to Messrs. Beardmore to construct machinery and plant of the nature described in a patent held by them, at Parkhead and Dalmain, Glasgow. There was a provision in the contract by which Messrs. Beardmore undertook not to supply the plans and details of the machinery and plant to third parties, or to let the knowledge or contents of them out of their immediate possession. Messrs. Beardmore did not oppose the application, either by lodging answers or by appearing; and the Lord Ordinary, on July 19, granted interim interdict. This order would have become perpetual; but the Power Gas Corporation interposed by lodging a minute, in which they sought to be sisted as parties to the cause, for the purpose of opposing the application. To this minute answers were lodged by complainers, who asked that the minute be dismissed.

Lord Ardwall stated his opinion to be that the Corporation had no right to be made parties to the action, which was founded entirely upon the contract between the complainers and Messrs. Beardmore, with which contract, or the performance of it, it appeared to him that the Corporation had no right to interfere, whatever supposed interest they might have to do so. The condition regarding the keeping secret of the plans and details of the machinery was a lawful and proper condition to be inserted in a licence; and the complainers were entitled to enforce it. Messrs. Beardmore had no answer, even if they had desired to make one—which they did not—to the granting of interdict as craved; but the Corporation intervened and pleaded that, by an indenture dated June 10, 1901, between the United Alkali Company, Limited (whose assignees the Corporation were), and Messrs. Beardmore and Co., and which granted a licence to the latter to use and exercise certain patented inventions, it was provided that the licensees would, at all suitable times, permit the granter, or any person nominated by him, to visit and inspect the works and machinery of the licensees in use for the manufacture of all or any of the bye-products named in the letters patent. There seemed little doubt that this would cover the machinery put up by, or under the directions of, the complainers at Messrs. Beardmore and Co.'s works; but there could be no doubt that, so far as regarded the question between Messrs. Beardmore and the complainers, the provision could have no effect whatever. If Messrs. Beardmore had disabled themselves from carrying out the contract in the indenture, that might give rise to an action of damages against them, at the instance of the Corporation; but he could not see how, in a question with the complainers, it could invalidate a condition under which the complainers granted their licence to Messrs. Beardmore. The Corporation further said the complainers were not entitled to the interdict they craved, or that the Court should not grant it, in respect of an undertaking given by Messrs. Beardmore in the English Courts, as appeared from a copy order by Mr. Justice Joyce, dated May 30, 1910—that undertaking being to give the plaintiffs' witnesses (Mr. Humphrey and Mr. Hogg) inspection of ammonia recovery plant. If this were so, it was an undertaking which, in a question with the complainers, Messrs. Beardmore and Co. were not entitled to give, and which could not be held to affect the complainers in enforcing their contract against Messrs. Beardmore. He might add, though it was not necessary for the decision of the matter, that it appeared to him that an attempt was there being made by the Corporation to take advantage of the clause in their indenture with Messrs. Beardmore and Co. to obtain information regarding certain secret processes, not patented but of importance to the complainers, and which were worked, along with the complainers' patents, at Messrs. Beardmore and Co.'s works. It would be noticed, from the amended statement of claim of the Corporation against Messrs. Beardmore and Co., in the Chancery Division, that the action, while nominally an action for royalties under the indenture of licence of June, 1901, endeavoured to bring in a statement implying that the complainers' apparatus and plant were infringements of the Corporation's patents. If this were so, the proper course for the Corporation to take was to bring an action against the complainers for infringement; but it seemed that they had, in 1908, raised an action in the High Court of Justice in England, against Messrs. Beardmore and Co., asking injunction against them for infringing certain patents, and for damages. This action was defended by the present complainers, in the name of Messrs. Beardmore and Co., in terms of the minute of licence; and after defences were lodged, it appeared that the Corporation abandoned the action and paid Messrs. Beardmore's costs. The action in which the undertaking by Messrs. Beardmore and Co was given was raised in 1908, and, as had been pointed out, was an action for accounting for royalties, to which the complainers had not been called, and could not appear, as defenders. They had now raised the present note of suspension and interdict it, to protect themselves against the inspection of their plant and machinery by representatives of rivals in trade; and he was of opinion that, under their contract with Messrs. Beardmore, the complainers were entitled to the protection they asked. In his opinion, the Corporation had no right to intervene in the present action; and he accordingly refused to sist them. With regard to expenses, it was open to doubt whether any decree for such could be competently pronounced against the Corporation. Seeing that they were not, and had not been, sisted as parties to the process, he thought the only safe course to follow was to give no expenses. He refused to sist the Corporation, appointed the minute to be withdrawn from the proceedings, and in respect of no answers having been lodged for Messrs. Beardmore and Co., the only respondents called, he declared the interim interdict already granted perpetual; and he found no expenses were due to or by either party.

TOWN COUNCILLOR'S GAS SUPPLY.

A Prosecution that Failed.

At a sitting of the Rawtenstall Police Court last Thursday, Peter Trickett, dentist, of Crawshawbooth, was summoned at the instance of the Rossendale Union Gas Company, firstly, for a breach of the Gas-Works Clauses Act, 1847, and, secondly, with stealing a quantity of coal gas.

The defendant, who is a member of the Rawtenstall Town Council, was represented by Mr. C. E. Sutcliffe; and Mr. J. L. Whitaker appeared to prosecute for the Gas Company.

Mr. Whitaker explained that there were two summonses issued at the instance of his clients. One of them charged the defendant with having laid, or known to be laid, a certain pipe to communicate with a pipe conveying gas to his house—a pipe belonging to the Rossendale Union Gas Company—without the consent of the Company, contrary to the Gas-Works Clauses Act, 1847. The other summons charged the defendant with having, between the dates mentioned, stolen a quantity of coal gas, the property of the Company. Mr. Whitaker submitted that it had been decided in more than one case—certainly in one—that for any kind of connection to be made with one of the Company's pipes without the consent of the Company, though it was done quite openly and without any fraudulent intent, was, in fact, an offence for which a penalty must be imposed. His chief difficulty in the present case was that he could not allege that this was done without a fraudulent intent. He was bound on the evidence he had to suggest to the Bench that, if the thing was done, it appeared to have been done fraudulently, and for the purpose of taking gas from the Company's pipes without passing through the meter. Since August of 1903, the defendant had practised as a dentist at Crawshawbooth, and had certain appliances there for which gas was used. Defendant had a gas-bracket adapted so that he might use it either for the purpose of lighting or for heating his boiler and the driving of a small engine. Compared with the gas consumption by his immediate predecessor, who was merely a householder and not in any kind of business, there was a marked diminution in the gas used, and there had been a tendency during the last few years for it to become less.

Evidence was given by Frank Carrington, an outside foreman in the employ of the Gas Company, and Joseph Clayton, a meter inspector. This was to the effect that about 10 o'clock in the forenoon of June 7 they visited the defendant, and had to wait something like a quarter-of-an-hour before being admitted. They examined the meter, which was in a cupboard up against an outside wall. Alongside the cupboard, and also against the wall, was a stone slab, and against this again was the slopstone. On getting a clear view of the meter, the officials found under the stone slab beneath the slopstone some woodwork; and when the woodwork was pulled away, it was discovered that there was a piece of india-rubber tube, about 12 or 15 feet long. Into the elbow of the service-pipe a brass tap had been inserted at some time, and the tubing was connected with the nozzle of the tap, and still underneath the woodwork. The officials, having made this discovery, went back to the Gas Company's office to report; and on returning the following day to take the elbow out and put a new one in, they found that a portion of the india-rubber tube had been torn off, leaving a small piece, however, which was produced in Court. If gas had been taken by the tap in the elbow, it would not have passed through the meter.

Mr. Sutcliffe argued for the defence that the tap and box arrangement, as found on June 7, was exactly in the same condition when Mr. and Mrs. Trickett took over the tenancy of the house seven years ago; that defendant knew nothing about the tube; that he did not, as suggested, between June 7 and 8 tear away the tube, and plug the tap; that the hole bored in the elbow had been bored by an expert, many years ago; and that as most of Mr. Trickett's dental work was done at his Burnley establishment, there was not much gas used at the house in Crawshawbooth. Mr. Sutcliffe added that it was common knowledge that outside Mr. Trickett's place in Crawshawbooth there used to be a public lamp which was lighted free of cost; and it appeared to him (Mr. Sutcliffe) that the tap had been put into the elbow for the specific purpose of supplying gas to that lamp, and that a hole was also bored in the cellar of Mr. Trickett's house to supply gas free to an Institute which at one time formed part of the premises.

Mr. and Mrs. Trickett gave evidence in support of this statement. Both strenuously denied having interfered with the tap or the tubing after the gas officials' visit on June 7. Asked to suggest a reason why the officials of the Company should state there was a piece of india-rubber tubing attached to the tap if such was not the case, Mr. Trickett declined to express any opinion—saying that he was not there to make allegations against anyone, but to speak the truth about himself. Mrs. Trickett strongly denied the suggestion that she kept the officials waiting at the door while the india-rubber tubing was torn off.

The Magistrates retired to consider their decision; and on returning into Court,

The Chairman (Mr. J. Ashworth) said: "The evidence is so conflicting that we have decided to dismiss the case."

Camborne Gas and Water Supply.—The accounts of the Camborne Gas Company for the year ended the 30th of June last, which were presented at the recent annual meeting, showed a sum of £626 available for distribution; and the Directors recommended the payment of a dividend at the rate of 3 per cent. for the six months, making 5½ per cent. for the year. The accounts presented at the half-yearly meeting of the Water Company showed a credit balance of £1048; and it was decided to pay dividends of 8 per cent. on the "A" shares and £5 12s. per cent. on the "B" shares.

MISCELLANEOUS NEWS.

PUBLIC LIGHTING OF WESTMINSTER.

Statement by an Electric Light Company's Secretary.

There has recently appeared in the electrical and other papers a statement by Mr. E. Willmot Seale, the Secretary of the Charing Cross, West End, and City Electricity Supply Company, Limited, on the subject of the street lighting in Westminster. The reason assigned for its publication is that the reports persistently appearing in the Press to the effect that electricity has been displaced by gas for street lighting "throughout that city" are untrue.* He says the facts are as follows.

The Westminster City Council transferred the lighting of that part only of the City of Westminster which has been hitherto very efficiently and economically lit by the St. James's Electric Light Company, to the Gas Company. This lighting comprised the supply to 66 arc lamps. The Westminster Electric Lighting Company, under contract, are still supplying, and will continue to supply until 1931, 970 arc lamps, and the Charing Cross Company, under contracts which do not expire for some years, 165 arc lamps, in the City of Westminster. It will be seen, therefore, that about 5¾ per cent. of the lighting previously carried out by the Electricity Supply Companies has been entrusted to the Gas Company.

These figures speak for themselves, and need no further comment on this head. When, however, so much attention is being called to the difference in the price quoted by the Electricity Supply Companies and the Gas Company respectively, it is only fair to the former that the conditions under which the respective prices were quoted should be understood and appreciated; and I therefore call attention to the following points.

The Electricity Supply Companies were invited, at considerable capital cost, to enter into a contract for five years, determinable at the expiration of that period at the option of the City of Westminster without compensation of any kind. Prices were also invited alternatively for ten and fifteen years contracts.

By the terms of the specification, the Electricity Supply Companies (the Gas Company's network of street lighting mains already covered the entire area) were compelled to quote for the whole of such specific district or districts as might be within their particular area of supply. The City of Westminster Council on their part reserved the right to select any part or parts of those districts for lighting by electricity, to the exclusion of other parts of the district, at the contract price per lamp quoted for the whole district. It is obvious, therefore, that the Electricity Supply Companies, in the event of the exclusion of parts of the district, might suffer serious loss.

The concessions of these Companies expire in 21 years, and all capital charges would have to be provided for within that period. The Gas Company is not purchasable by the local authority, and has, therefore, a practically unlimited period in which it would be possible to deal with capital charges.

The furnishing of the supply by the Electric Light Companies would have necessitated the laying of additional cables and construction of other works involving a very large capital expenditure. With the Gas Company, as to the greater portion of the work involved, mains were already laid and capital expenditure made.

The terms of the specification imposed by the Westminster Council were thus (unintentionally, no doubt) exceedingly unfair to the Electric Light Companies, and, owing to the existing conditions, were relatively favourable to the Gas Company.

In circumstances such as these, could the Electric Light Companies do otherwise, on business lines, than safeguard their shareholders' interest by making provision for these capital charges and contingencies in the price quoted per lamp? What could have been done if the specification had been framed so as to allow the Companies, as well as the City of Westminster, to select convenient portions of districts for tender, is evidenced by the fact that the St. James's Company, owing to matters which transpired at the Westminster City Council meeting on the 14th of April last, offered to continue their supply to the section then lit by them at a price which compared not unfavourably with the Gas Company's. Their request, although supported by nearly the whole of the principal shopkeepers in the area, was refused, on the ground that it had already been decided to place the contract with the Gas Company.

It has also been published abroad that the City of Westminster will effect very large savings by the arrangement with the Gas Company. This is not accurate *quâ* electric lighting. The City of Westminster in this connection is saving only the small difference between the low price charged by the St. James's Company and the cut-prices offered by the Gas Company. If, therefore, a saving is being effected, it is probably due to the drastic revision of the Gas Company's own prices for the supply they themselves have hitherto given in the City of Westminster.

The question, whether or not the contract will pay the Gas Company other than as an advertisement, is, of course, one for themselves and their shareholders. But an analysis of their published accounts would appear to show their costs are 1s. 10d. per 1000 cubic feet, while the contract price, which includes capital charges for street work, would appear to yield certainly not more than 1c½d. per 1000 feet, as against 2s. 8d. per 1000 feet charged to the general public. Would it be very unfair to deduce that considerations of advertisement and preference had an undue bearing upon the composition of the prices tendered by the Gas Company?

To put the matter shortly, making allowance for the considerations mentioned in the preceding paragraph, the whole of the difference between the prices tendered by the Gas Company and the Electric Lighting Companies respectively is due to this question of capital charges in connection with the short unexpired periods of the Provisional Orders, the duration of the proposed contract (five years), and the handicapping conditions imposed by the terms of the tender upon the Electricity Supply Companies, and not to the price at which electricity could be sold under ordinary and reasonable conditions.

* Allusion to this letter is made in "Electric Supply Memoranda" this week.

The method of arriving at the above figures of 1s. 10d. per 1000 cubic feet, the cost to the Gas Company of the gas sold to the public at 2s. 8d. per 1000 cubic feet, and 10½d. the price likely to be obtained by the Company under their contract with the City of Westminster, is set out by Mr. Seale in a communication to the "Electrician." In the course of it he makes the following remarks.

According to Mr. Bradley's report published in the "Electrician" of March 11, 1910, a 1000 candle power (nominal) high-pressure gas lamp, giving an average candle power of 880, takes 30 cubic feet of gas per hour. Therefore a 3000-candle lamp must take at least 90 cubic feet, or (say) 1000 cubic feet per 11 hours. As the number of lighting hours per annum is 3940, the total consumption of gas would be 354,600 cubic feet. With gas at 10½d. per 1000 cubic feet, the cost of 354,600 cubic feet is £15 10s. 3d.; leaving for the maintenance of 3000-candle power lamps (three mantles) £6 9s. 9d.—the contract price, £22.

It should be noted that maintenance items are not chargeable against private consumers in the price of 2s. 8d. per 1000 cubic feet. So this item is therefore omitted in the comparison; and the figure of 10½d. compares with 2s. 8d. Also, when the extreme urgency of the conditions relating to maintenance of candle power for the street-lamps is borne in mind, it will be evident that the above sum allowed for maintenance will probably be exceeded.

Moreover, no allowance has been made for capital charges. In this connection, it is true that the expenditure has already been incurred in the greater part of the area. But we understand that special mains are being laid for the 3000-candle power lamps; so that the figure of 10½d. must include capital charges, and make the price more inadequate still.

In regard to the cost of manufacturing the gas, the following figures are taken from the half-yearly accounts to Dec. 31, 1909, of the Gaslight and Coke Company:—

		1000 Cub. Ft.
Gas sold by meter		10,846,734
Gas sold for public lighting and contracts		445,772
Gas manufactured		12,109,500
Costs—		
Total costs, including distribution		£1,424,941
Less lighting and repairs of public lamps	£19,573	
,, depreciation of works on leasehold lands	500	
,, received for residuals	367,517	
		387,590
		£1,037,351

The cost per 1000 cubic feet of gas manufactured is therefore 1s. 8½d., and the cost per 1000 cubic feet of gas sold 1s. 10d.

ELECTRIC LIGHTING AT PETERBOROUGH.

Local Government Board Inquiry.

At the Guildhall, Peterborough, last Tuesday, an inquiry was held by Mr. F. H. Tulloch, M.Inst.C.E., into an application made to the Local Government Board by the Corporation, for authority to raise £2100 for electric lighting purposes. This sum was made up as follows: Extension of mains, £1120; street lighting, £310; additions to plant, £670.

The Deputy Town Clerk (Mr. W. T. Mellows) defined the district in which it was proposed to lay the new mains, and said the Electricity Committee had received applications during the past year or two from eight residents to instal electricity in their houses or premises; but, owing to there being no mains laid in the roads, these applications had been reluctantly refused, with the result that gas was at present installed in the houses. The Committee were therefore of opinion that, in the interests of the undertaking, the time had arrived to extend the mains along the roads specified, so as to be in a position to supply the new houses before gas was installed as the system of lighting. Until last year, the financial result of each year's working showed a steady improvement in the figures; and in 1907, 1908, and 1909 a surplus was realized after providing for interest and repayment of loans. Last year, however, the undertaking suffered a heavy loss through arbitration proceedings with the Peterborough Traction Company, who applied for a revision of the price at which electricity was supplied to them for power purposes. They had to refund £268, the cost of the proceedings was £1016, and £476 had been spent for new mains—making together £1760. There was a deficit on the year's working of £1831, or, regarding the last-named items as extraordinary expenditure, £41. The total amount of loans previously sanctioned for the electricity works was £54,317, of which £13,862 had been repaid or provision made for repayment. The amount of loans outstanding was £44,581. The last sanction was for £2880 for new mains and feeders, for which a period of 25 years was allowed.

The City Engineer (Mr. J. C. Gill) said the application might be divided into two parts—first, £1430 for laying new mains, promoted with the object of increasing the revenue; and, secondly, £670 for appliances at the generating station, the object of which was to enable the present plant to work more efficiently and economically. The station would not be complete without the proposed equipment. The adoption of metallic filament lamps had had a serious effect upon the consumption of electricity for power.

Mr. Norris (representing certain ratepayers) opposed the application. He said that when it was first proposed to start electricity works in Peterborough, there was considerable opposition, and several inquiries were held, at which large numbers of ratepayers were represented by Counsel. The Inspectors conducting the inquiries reported against the

establishment of electricity works in the city; and it was not until the Electricity Committee attended at the Board of Trade that the scheme was sanctioned. Since the works started, there had been a deficit of £7547, which had been paid out of the district fund as rates. It would therefore be seen that it was a serious question, from the ratepayers' point of view, as to how far this tremendous charge on the rates was to be allowed not only to continue, but, he feared, rather to increase. At any rate, the past year's trading had shown a rather disastrous result. Certainly, it was brought about to a great extent by unforeseen circumstances; but apparently they had a white elephant among them. They felt bound, it seemed, to keep it up; but what they objected to was the further increase of liabilities by the sanction of the proposed loan. Peterborough was a peculiarly constituted city, inasmuch as the great bulk of the inhabitants were of the working classes, and they would never be likely to require electric light. In support of his contention, he pointed out that a few years ago quite seven-eighths of the houses in the city were illuminated by oil-lamps; and it was only in recent years that gas had been adopted for cooking purposes through the medium of the penny-in-the-slot meters. Coming to the question of the cost of gas and electricity, Mr. Norris asserted that the comparative prices worked out very much against the latter illuminant. The difference in the cost of lighting the streets by gas and electricity was a very important item; and at a time like the present, when many public bodies in London and elsewhere were installing gas in the place of electricity, it was a very undesirable thing that electric lighting should be increased in a city like Peterborough. The cost of lighting five miles of streets to-day by electricity was £1000 more than it was when lighted by gas. From figures obtained from the Borough Surveyor, there were in the city 34 miles of streets, 5 miles of which were lighted by electricity, at a cost of £1653. The remaining 29 miles were lighted by gas, at a total cost of £2401. The actual cost per mile for electric light was £330 12s., and for gas £82 16s. 4d. In order to ascertain the cost of gas if it were used in the principal streets, he had added one-half as much again—£41 8s. 2d.—making the cost per mile in the main streets £124 4s. 6d. for gas. The cost for 5 miles of streets electrically lighted was £1653, and the cost of gas would be £621; leaving a balance, on this assumption, in favour of gas, of £1032. The ratepayers he represented believed that public lighting by electricity was a most expensive thing, and ought not to be extended. The only part of the city that could possibly yield a profitable return was already supplied; and they considered that the remaining portion should not be lighted by electricity, because they knew for a fact that, except where large carbon lamps were burnt at an enormous cost, the light given by the incandescent electric lamps was not so good as that afforded by gas. It was causing a large amount of extra rate to be expended, and great care should be taken that the charge on the rates should not be increased. He suggested that the amounts asked for should not be sanctioned, as he was quite sure they would never show a profit.

The DEPUTY TOWN CLERK having dealt with some of Mr. Norris's remarks,

The ENGINEER took up the subject of the public lighting. He said that in comparing the cost they could not take 5 miles of streets in the centre of the city and contrast them with 29 miles on the outskirts. The only way was to take the same streets and compare the cost when lighted by gas and by electricity respectively. If they took the principal business streets of the city, which were now lighted by electric arc lamps, and compared the cost with that previously paid for gas, they found the annual cost was greater for gas than for electricity, while the electric lamps gave ten times the light. With regard to the lamps in the outer part of the city, they had two incandescent lamps of 50-candle power on each column where they had superseded the gas-lamps, and they cost the same as the gas.

The INSPECTOR: You can do that at the same price as gas without loss, and give the same light?

The ENGINEER: Yes; and I say we give a much better light.

Mr. NORRIS said that in 1900 the whole city was lighted by gas for £2267, while last year electricity alone for the 5 miles of streets cost £1653.

The ENGINEER explained that a great many more streets were lighted now than there were then.

Mr. NORRIS said there could not be more than a mile. In 1900, when there were at least 32 or 33 miles, the cost of gas for the whole area was only £2267; whereas last year the electric light cost £1653. The cost of gas and electric lighting together was £4054, which was nearly double what it was in 1900, when no electricity was used. This sum seemed to him to be prohibitive and showed that the extension of electricity should not go on indefinitely.

The DEPUTY TOWN CLERK explained that there were a great many streets and bye-ways lighted now that were not lighted in 1900.

Alderman CLIFTON (the Chairman of the Electricity Committee), in supporting the application, said the Committee had come to their decision after the fullest consideration; and they felt thoroughly justified in proceeding with the proposed works.

The inquiry then closed.

MUNICIPAL LOANS FOR TRADING UNDERTAKINGS.

Local Government Board's Right to Dispense with a Public Inquiry.

Mr. P. Percival, Secretary to the Manchester Ratepayers' Association, has not as yet received a reply from the Local Government Board to his communication asking upon what authority the Board relied for dispensing with a public inquiry in reference to the Electricity Committee of the Manchester Corporation and a loan of £40,000 for extensions at the works—a matter that was referred to in the last issue of the "JOURNAL." Mr. Percival has, however, been informed by the Electricity Committee that the Board acted as they did by virtue of the Electric Lighting Act, 1909. "That being so," says Mr. Percival, "the action of the Board may be perfectly legal; but yet my Association think it may be destructive to the interests of the ratepayers as a body, and against the best principles of local government."

According to information supplied by the Electricity Committee, it seems that tentative sanctions for raising loans to the amount of £40,000 were granted in 1907; and this money has been spent. Mr. Percival, explaining how it was expended, says: "In round figures, the sum of £30,000 has been spent in providing equipment for 23 consumers. These consumers, with one exception, are large manufacturers; and they are, according to the admission of the Electricity Committee, supplied with current at cost price. The total capital outlay of the Electricity Committee is £2,680,000; and the sole return from this to the general body of the ratepayers this year is £15,000, or less than three-quarters per cent., obtained under great pressure. The policy underlying these transactions is greatly open to question, especially as the Gas Committee have so much capital of the citizens invested in their undertaking—an undertaking we are in the habit of looking to annually to prevent an increase in the rates. In any case, the operations of the Electricity Committee ought to be dealt with in full daylight, when applications for large sums are made; for it is only at a public inquiry that the policy of the Committee can be searchingly, and therefore adequately, examined. The action of the Local Government Board is a new departure, and in the wrong direction. It ought to be resisted in every legitimate manner possible."

EASTBOURNE GAS COMPANY.

Presiding at the half-yearly meeting of the Eastbourne Gas Company, the Chairman (Dr. G. A. Jeffery, J.P.) remarked that the sales of gas for the six months to June 30 amounted to 220 million cubic feet, as against 213 millions in the corresponding period of the previous year, or an increase of 4½ per cent. This increase was partly derived from the extension of the mains to the Hailsham district. The total number of consumers was 9739—4846 ordinary, and 4893 prepayment. This showed a gain on the year of 793 consumers. Coal and oil cost £16,953 in the half year, as against £16,876 in the first six months of last year; the price of coal having been 17s. 5d. per ton, compared with 17s. 1d. The capital expenditure was now £191,841, a sum equal to £415 per million cubic feet on the sale last year of 458½ million feet. The net profit for the past half year was £8777, as against £7456 in the corresponding period of last year—an increase of £1321, or 9·46 per cent. The report and accounts were adopted; and dividends were declared for the half year at the rates of 7¾ per cent. per annum upon the "A" stock, 6¼ per cent. per annum upon the "B" stock, and 5 per cent. per annum upon the 5 per cent. preference stock. Thereafter the salary of the Secretary (Mr. J. S. Garrard, F.C.I.S.) was increased by £50 per annum, free of income-tax; and a vote of thanks was accorded to the Directors, officers, and workmen for the care with which they had conducted the affairs of the Company, as shown in the accounts and by the growth of the business. The services of the Chairman were also acknowledged.

SALISBURY GAS COMPANY.

At the recent annual meeting of this Company, the Chairman (Mr. George Fullford), in moving the adoption of the report and accounts, and the payment of the usual dividends, said the work during the past year had been satisfactory; and he could again congratulate the shareholders on the position of the business. The recent reduction in the price of gas represented a loss of £860 per annum to the Company, and a corresponding gain to the consumers. The Directors always had in view the desirability of fully and efficiently maintaining the plant necessary for the manufacture, purification, and distribution of gas; and the Engineer and Manager (Mr. Norton H. Humphrys), who was an expert in these matters, was ever ready to adopt any recognized improvement. Some alterations were in progress at the works. The fitting, service, maintenance, and other departments of the outside staff had been fully occupied during the year; and consumers gladly appreciated the economy and the other advantages of having their burners and mantles kept in proper order by experienced hands. In view of the installation of the high-pressure system of gas lighting at Westminster and elsewhere, the Engineer had been instructed to arrange an exhibition of the system at the town office of the Company. The Directors desired to recognize most fully the excellent work carried on by Mr. Humphrys, the capable services of Mr. A. Whitehead, the Secretary, and the foremen of the several departments, and the whole of the staff, for he felt that one and all had co-operated in assuring the success of the undertaking during the past year. The report was unanimously adopted; and the thanks of the meeting were accorded to the Chairman, Directors, and staff for their services.

NEW MILLS GAS-WORKS EXTENSIONS.

Local Government Board Inquiry.

Mr. A. W. Brightmore, M.Inst.C.E., one of the Inspectors of the Local Government Board, recently held an inquiry at the offices of the New Mills Urban District Council in regard to an application by them for sanction to borrow £3400 for extensions at the gas-works and the provision of water-gas plant. The Clerk to the Council (Mr. Joseph Pollitt) explained that in 1905 they had 827 gas consumers, whereas now they had 1411—an increase at the rate of 70 per cent. The quantity of gas made in the year 1904-5 was 26,178,000 cubic feet; for the past year it was 41,674,000 cubic feet, or an increase at the rate of 60 per cent. The average annual make was now about 42 millions; and they had 820 cookers and grillers in use. The Gas Manager (Mr. P. Lancashire) furnished particulars of the proposed extensions; the amount to be spent on the water-gas plant being put down at £1500. He added that there was no doubt the plant would be a great acquisition to the works, and would obviate, at any rate for the present, the necessity for the construction of a gasholder at a cost of about £4000. Mr. Billinge, who supported the application, referred to the progress made since the gas-works were acquired by the Council. He said they had been almost rebuilt; and the price of gas had been very greatly reduced.

GAS STOKING MACHINERY FOR PERTH.

The Gas Committee of the Perth Town Council have approved the report of a Sub-Committee in reference to the proposal to introduce stoking machinery into the gas-works.

The report stated that the present system of charging and discharging retorts consists of coal breaking, elevating, and conveying machinery, overhead coal-storage bunkers, and four hand-stoking appliances. It is proposed to take advantage of the existing coal breaking, elevating, and (it is anticipated) conveying plant; and greater economies will be effected by working it in conjunction with a new charging and discharging machine. None of the existing plant will require to be displaced except hand-stoking appliances, two of which can be sold, and two retained as a stand-by. Circumstances have entirely changed since the hand appliances were installed. Not only has the output of gas greatly increased, but the methods for the carbonization of coal have been practically revolutionized. The development of the vertical retort, and the improved results obtained from chambers packed full of coal, has attracted the attention of gas engineers to the possibility of obtaining improved results from the existing horizontal system by increasing the thickness of the layer of coal in the retort. By the new system a charge of 16 cwt. of coal may be laid in a through retort at one operation; the process of opening the retort doors, discharging the coke, and refilling the retort with coal occupying the space of only 55 seconds. To carbonize 100 tons of coal by this system—the average daily consumption during the winter months in Perth—only 125 charges would be required per twenty-four hours day. To perform this work and attend to the other duties of the retort-house, only three men per eight-hour shift would be employed. At the present time, five to six men are required to perform this work, because the coal is laid in 560 charges of 3½ cwt. each; and in the charging and drawing operations four hand-worked rakes and four hand appliances are employed. The report of the Manager, dated Nov. 23 last, showed that the proposed work could be carried out at an initial outlay of £3900. The money saving to be effected by the introduction of machinery, it is estimated, will amount to the net sum of £700 a year, after providing for repairs and maintenance, and interest and sinking fund charges.

The Committee, after careful consideration, unanimously approved of the Manager's report, and appointed a Sub-Committee to institute further inquiries regarding the De Brouwer projector and discharger, the best example of which could be seen at Derby, where the system has been in operation for about six years, and the Fiddes-Aldridge simultaneous charger and discharger, which has been in operation in Liverpool for four years. The Sub-Committee made inquiry at twelve gas-works using the De Brouwer machine, and of a like number using the Fiddes-Aldridge machine, in order to ascertain the practical results obtained by them. After full and careful consideration of all the features of the various machines which were inspected, the Sub-Committee were unanimously of opinion that the De Brouwer combined charger and discharger, as seen at Derby, was better adapted for Perth than any of the others; and while the prime cost did not unduly influence the Sub-Committee, it was a point in its favour that the initial cost of the De Brouwer machine was less, and the cost of maintenance was not more, than any of the other machines. The Sub-Committee therefore unanimously recommended the adoption of the De Brouwer machine. It had been urged that the hand appliances, which were put to work ten years ago, should be continued in use until their original cost had been redeemed. But as it had been considered prudent to retain two of these machines as a stand-by, only two machines, of the original value of £420, would require to be disposed of; and the difference between the price which these will bring and the original cost will not amount to more than £250—a trifling sum compared with the saving to be effected of money and labour by the new system, and one which could be cleared off during the first year's working of the new plant. The following is a detailed statement of the annual saving estimated by the adoption of the new machine.

Reduction in coal account, due to increased yield of gas	£613	15	0
Reduction in working expenses (wages)	448	8	4
Total saving	£1062	3	4
Less annuity to repay £3900 (the initial outlay) in ten years, calculated at 3½ per cent., compound interest	332	8	9
Net annual saving	£729	14	7

It has been urged that further capital expenditure at the Friarton Gas-Works is not desirable at present, owing to the already heavy capital on the undertaking. It is not now proposed to incur capital expenditure. It may be recalled, however, that the works, as originally planned in 1897-98, when the make of gas was at the rate of 138,357,000 cubic feet per annum, were estimated to cost £75,000—leaving contingencies out of account. Yet at May 15, 1910, when the output had reached 226,553,000 cubic feet per annum, the total expenditure on the new works had only reached £75,898. As the result of the increasing popularity of gas, and the extension of the gas supply area from time to time, considerable expenditure has been incurred in providing new mains, meters, and stoves. During the period from May 15, 1902, to May 15, 1910, the number of gas consumers has increased from 8804 to 10,025; and the number of cooking and heating appliances hired or sold by the Corporation has increased from 3048 to 10,798. During the eight years from May 15, 1902, to May 15, 1910, the gross capital expenditure was £38,624. In the same period, £10,937 has been repaid in respect of gas-stored capital and parliamentary expenses on Bills, and £36,891 has been carried to the sinking fund for redemption of loans—total £47,828. Taking into account this rapid rate of repayment, together with the fact that the capital account on the undertaking is now practically closed, and that the business is increasing most satisfactorily, the finances of the department are in a healthy condition. As an indication of the stability of the concern, it may be stated that during the period from May 15, 1902, to May 15, 1910, the output of gas has increased by 25·1 per cent.; and while the capital charges per 1000 cubic feet of gas sold have increased from 11·15d. to 1s. 0·8d., the cost of manufacturing and delivering the finished gas into the holders, including all materials, renewals, repairs, maintenance, salaries, and wages, has been reduced from 1s. 8·22d. to 10·37d. per 1000 cubic feet sold, and the average price of gas to consumers has been reduced from 3s. 3·61. to 2s. 10·57d.

The Sub-Committee were satisfied that the introduction of new automatic stoking machinery, as proposed, would effect further economies, and that the saving resulting from its use would be sufficient to repay the total initial outlay in a few years' time, without having recourse to capital expenditure.

GAS AND WATER UNDERTAKINGS IN RHYMNEY VALLEY.

A Transfer Agreement Arrived At.

The decision arrived at by the Bedwellty Urban District (Rhymney Valley) Council last week to purchase the undertaking of the New Tredegar Gas and Water Company, and that by the Caerphilly Council to purchase the Rhymney and Aber Valleys Gas and Water Company's works, will place the supply of these commodities in the whole of the Rhymney Valley under the absolute control of the local authorities. The decision is being hailed with general satisfaction, writes a Rhymney Valley correspondent, and is the goal for which many of the progressive councillors have been struggling, together with the local Press, for a very considerable period. The situation generally is, however, a very complex one, because the areas under control by the respective Companies dovetail so much into each other. The New Tredegar Company have in reality no water-works, nor even storage reservoirs; but they own a profitable undertaking in the gas-works. Though the price has not yet been divulged, it is understood that the interests of the ratepayers have been well protected.

The question of the purchase of the Rhymney and Aber Valleys Company's works was first brought about two years ago, in connection with the Glamorgan Water Bill. A formidable objection to the Bill was lodged by the Rhymney Valley authorities. Ultimately the opposition was withdrawn, upon certain conditions, one of which was that the District Councils interested in the area of supply of the Rhymney and Aber Company should have the right to purchase the whole of the undertaking—such option to remain in abeyance for three years. This period will expire next August. Joint conferences have been held to bring the option into effect. The Caerphilly and Gelligaer Councils, who have the local administration on the Glamorgan side of the valley, and the Rhymney, Bedwellty, Mynyddislwyn (Urban), and St. Mellons (Rural) Councils, who control affairs on the Monmouth side, attended the preliminary conferences. The Rhymney Council were the first to break away from the combine, because they had secured preferential treatment under the Rhymney and Aber Act. The Company were by Statute bound to deliver a minimum quantity of water to them each day at a fixed price, and the Council then became the distributors. In the matter of gas, the Company hold the monopoly; but a clause is inserted in the Act fixing the maximum charge which can be levied by the Company for the commodity. Thus, in consequence of this preferential treatment, Rhymney now hold simply a "watching brief" in the negotiations.

The Bedwellty Council were next to fall away from the Joint Board. The Council have for many years been the distributors of water to a very large proportion of the New Tredegar and Cwmsyfiog districts of the Council's area. This water is supplied to them by meter by the Tredegar District Council. The Aberbargoed and Pengam portions of their area are, however, under the jurisdiction of the Rhymney and Aber Company. With the prospect of the purchase of the New Tredegar Company's undertaking, it was thought inadvisable for them to continue with the Joint Board scheme any further.

Mynyddislwyn, who have a small portion of their district at Fleur-de-Lis, and the St. Mellons rural district, with the extensive developments at Bedwas, were, however, wholly dependent on the Rhymney and Aber Company, and consequently remained in the combine as "paying-guests." On the Glamorgan side of the valley, Gelligaer, with the exception of the Tirphil ward, are entirely in the hands of the Rhymney and Aber Company for both water and gas. True, there is an Electric Light Company at Bargoed, who have powers over the whole of the valley; but at present their operations are confined to Bargoed. The members of the Gelligaer Council, however, hold different views on the matter of municipalization; and though the reports from the conferences have repeatedly come up for discussion, there has not yet been a whole-hearted line of policy adopted.

Caerphilly occupy an equally important position so far as the operations of the Company are concerned; and, with the exception of the Taffs Well and Nelson wards, are entirely dependent on the Rhymney and Aber Company. Some six years ago, they entered into, and completed, negotiations with the South Wales Electric Light Supply Company to secure current from the Treforest Works for street lighting in the Aber Valley and Llanbradach; but the Company, having got into difficulties, they did not carry out the obligations referred to.

Unless steps were taken forthwith to issue the statutory notices, it became obvious that the clause secured during the discussions in London on the Glamorgan Water Bill would not be operative. With Rhymney and Bedwellty having abandoned the combine, Gelligaer in an undecided mood, and Mynyddislwyn and St. Mellons simply as purchasers, the Caerphilly Council alone became the "whole-hoggers." It speaks much for the democratic spirit of this Council that they have decided to tackle the enormous undertaking. There is, however, every probability that they will shortly be joined by Gelligaer. The combined rateable value of these two Councils is nearly £225,000, and the population close upon 50,000. There is a well-founded rumour that, in order to simplify matters of administration, the Bedwellty Council will offer an exchange of districts, and surrender their gas and water rights at Tirphil and Brithdir in return for the Rhymney and Aber Company's powers at Aberbargoed and Pengam. But it is premature for any decision upon this matter.

BIRKENHEAD CORPORATION WATER SUPPLY.

The Alwen Scheme.

Readers of the "JOURNAL" are aware that the Birkenhead Corporation have decided to proceed without further delay with their scheme for bringing a new water supply from large reservoirs to be constructed on the River Alwen. Although the undertaking will not approach in magnitude the Liverpool reservoirs at Vyrnwy or the Radnorshire supply of the Birmingham Corporation, it will be a very considerable one, involving ultimately an expenditure of £1,750,000. On its completion, three large centres of population will be drawing their water supplies from the North or Mid Wales watersheds. The following particulars in regard to the scheme have been furnished by a correspondent to the Engineering Supplement to "The Times."

Birkenhead obtained its parliamentary powers three years ago, and the Act allowed ten years for the execution of the scheme. Three years of this time have already elapsed. The immediate reasons for now deciding to proceed are that the water from the wells which form part of the present sources of supply is diminishing in quantity, and that a slight deterioration in quality is also noticed. It is estimated that a period of five years will be required for the completion of the dam and first reservoir from the time of cutting the first sod to the actual turning on of the water; and six months will probably be taken up beforehand in letting the contract and other preliminaries.

The original Engineer of the scheme was the late Dr. George F. Deacon; but after his death Sir Alexander Binnie, Son, and Deacon were appointed in his place. The scheme provides for the construction of three reservoirs, to be built at successive periods as required. The first will have a total capacity of 3500 million gallons, and it is proposed to take 7 million gallons a day for the supply of the borough. The second reservoir, which is to be constructed when necessary, will hold 1700 million gallons, yielding a supply of 5·9 million gallons a day, with a possible surplus of at least a million gallons daily from the first reservoir. It is not expected that the third reservoir will be required for a considerable number of years. The estimated cost of the first reservoir is £740,000, and of the second £545,000; and the aggregate expenditure for the entire scheme is put at £1,750,000. The population of Birkenhead will probably be between 130,000 and 140,000 when the first reservoir is completed; and there is a surrounding population that is continually increasing.

Two mountain watersheds are included in the area of 6313 acres from which the water supply will be drawn; and the first reservoir will be 1200 feet above the level of the sea. The third reservoir will eventually be formed below the confluence of the Alwen and another stream. The length of the dam of the first reservoir will be 458 feet, and its height 92 ft. 6 in. The top-water area of the reservoir will be 375 acres, and its length will be about three miles. The water-main will cross the Vale of Clwyd to the south of Ruthin, pass south of Moel Fammau towards Mold, in Flintshire, on into Cheshire by Burton, and finally discharge into a large reservoir to be formed at a sufficiently elevated point a few miles from Birkenhead.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

On another page, an account is given of a proposal by the Gas Committee to introduce stoking machinery into the Perth Corporation Gas-Works. The recommendation has come from the Gas Committee with unanimous voice. It is expected that when the matter comes before the Town Council there will be opposition to it. It may be regarded as natural that those members of the Council who were not privileged to go on deputations to view stoking plant in use in other works will, notwithstanding that they know next to nothing on the subject (perhaps because of their ignorance), bear a critical attitude towards the proposals of those who have been studying the problem for months. Although opposition is anticipated, there is every reason to believe that it will not be sufficient to bar the progress of the Gas Committee in their endeavour to bring the gas-works more up to date than they have become in the short space in which they have been open. It is probably on account of the desire to have the carbonizing plant more worked out than it is as yet, that there have been no proposals for either inclined or vertical retorts. For a time (for how long we cannot tell) carbonizing at Perth is to be done in horizontals. This decision, we must assume, has been arrived at intentionally. Mr. M'Lusky is sufficiently wide awake to be aware of what can be done in retorts set in other fashion; and if he has elected to continue horizontals in practice, we can only conclude that, at present at least, he does not see where would be the advantage to the undertaking of either inclines or verticals. I have called attention to this feature of the Perth proposals because of my belief in Mr. M'Lusky's rectitude of judgment on all matters he applies his mind to, and of the reflective value which the decision of one so well versed as he is in current conditions must have in the case of others who are studying the same subject.

The Greenock Town Council on Thursday fixed the prices of gas for the year. Bailie Taylor, the Convener of the Gas Committee, moved that the price to ordinary consumers be reduced from 2s. 10d. to 2s. 9d. per 1000 cubic feet, and that for power purposes the price remain at 2s. 6d. The minutes showed that in Committee Bailie Chalmers had moved that a reduction of 2d. be made, but that his motion was lost by eight votes to three. In the Council, Dean M'Callum said he had hoped that some of the surplus of £7000 would have been applied towards the relief of taxation, as it was anticipated that there would be an increase of the rates. He should also have liked to see another penny off the price of gas; but as the Convener and the Manager were anxious to have a fair surplus to work upon at this time, and as they had just come out of what he might call a state of chaos, he did not wish to press an amendment. The Convener's motion was agreed to.

The Corporation of Glasgow have adopted the recommendation of the Gas Committee, foreshadowed in these "Notes" last week, that they should undertake the supply of gas-fires on the hire-purchase system. The payments are to be twelve in number, quarterly, which will make the article hired the property of the consumer at the end of three years from the first payment. Arrangements have been made with

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 571.

Issue.	Share.	When last Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,474,000	Stk.	Apl. 1	5	Alliance & Dublin Ord.	80–83	..	6 0 5
310,000	Stk.	July 14	4	Do. 4 p.c. Deb.	97–99	..	4 0 10
200,000	5	May 12	7	Bombay, Ltd.	⅞–6½	..	5 7 7
40,000	5		7	Do. New, £4 paid	4⅜–5⅛	..	5 9 3
50,000	10	Feb. 25	15	Bourne- to p.c.	29–30	..	5 0 0
311,810	10	,,	7	mouth Gas B 7 p.c.	16¾–16⅞	..	4 3 7
75,000	10	,,	6	and Water Pref. 6 p.c.	15–15½	..	3 17 5
380,000	Stk.	Aug. 12	12½	Brentford Consolidated	246–249*	..	5 0 5
330,000	,,	,	9⅜	Do. New	184–186*	..	5 2 2
50,000	,,	,,	5	Do. 5 p.c. Pref.	—	..	—
206,250	,,	June 10	4	Do. 4 p.c. Deb.	99–101	..	3 19 3
220,000	Stk.	Mar. 16	11	Brighton & Hove Orig.	214–217	..	5 1 5
246,320	,,	,,	8	Do. A Ord. Stk.	153–156	..	5 2 7
460,000	20	Apl. 1	10⅜	British	44⅜–45½	..	4 13 5
109,000	Stk.	Aug. 12	6	Bromley, A 5 p.c.	117–119*	..	5 0 10
165,700	,,	,,	4½	Do. B 3½ p.c.	88–90*	..	5 0 0
82,278	,,	,,	5⅜	Do. C 5 p.c.	106–108*	..	5 1 10
55,000	,,	June 29	3½	Do. 3½ p.c. Deb.	85–87	..	4 0 6
250,000	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	97–99	..	4 0 10
100,000	10	—	—	Cape Town & Dis., Ltd.	3–4	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	5⅜–6⅜	..	—
50,000	50	May 3	6	Do. 6 p.c. 1st Mort.	49–50	..	6 0 0
100,000	Stk.	June 29	4½	Do. 4½ p.c. Deb. Stk.	88–90	..	5 0 0
157,150	Stk.	Aug. 12	5	Chester 5 p.c. Ord.	108⅜–110⅜*	..	4 10 6
1,513,280	Stk.	,,	5⅗	Commercial 4 p.c. Stk.	105–107*	..	4 17 2
560,000	,,	,,	5	Do. 3½ p.c. do.	101–103*	..	4 17 1
475,000	,,	June 29	3	Do. 3 p.c. Deb. Stk.	80–82	..	3 14 2
800 000	Stk.	June 10	5	Continental Union, Ltd.	95–97	+2	5 3 1
200,000	,,	,	7	Do. 7 p.c. Pref.	135–137	..	5 2 2
492,270	Stk.	—	5½	Derby Con. Stk.	122–124	..	4 8 9
55,000	,,	—	4	Do. Deb. Stk.	101–105	..	3 16 2
148,995	,,	Apl. 1	5	East Hull 5 p.c. Ord.	96–98	..	5 2 0
486,090	10	July 14	12	European, Ltd.	23¼–24	..	5 0 0
354,060	10	,,	12	Do. £7 10s. paid.	17⅞–18⅛	..	4 18 8
16,179,445	Stk.	Aug. 12	4⅜	Gas 4 p.c. Ord.	105–106*	+⅛	4 8 0
2,600,000	,,	,,	3⅜	light 3½ p.c. max.	87–89*	..	3 18 8
4,062,235	,,	,,	4	and 4 p.c. Con. Pref.	102–104*	..	3 16 11
4,531,705	,,	June 29	3	Coke 3 p.c. Con. Deb.	81–92	..	3 13 2
258,740	Stk.	Mar. 16	5	Hastings & St. L. 3½ p.c.	94–96	+1	5 4 2
82,500	,,	,,	6½	Do. do. 5 p.c.	117–119	..	5 9 3
70,000	10	Apl. 29	11	Hongkong & China, Ltd.	17–17⅛	..	6 5 9
131,070	Stk.	Mar. 16	7⅜†	Ilford A and C	147–150	+2½	4 18 4
65,780	,,	,,	5⅜†	Do. B	114–116	..	5 1 3
65,500	,,	June 29	4	Do. 4 p.c. Deb.	93–100	..	4 0 0

Issue.	Share.	When last Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
4,940,000	Stk.	May 12	9†	Imperial Continental	184–186	+7	4 16 9
1,235,000	Stk.	Aug 12	3⅛	Do. 3½ p.c. Deb. Red.	92–94*	..	3 14 5
200,242	Stk.	Mar. 16	6	Lea Bridge Ord. 5 p.c.	122–124	..	4 16 9
561,000	Stk.	Feb. 25	10	Liverpool United A.	219–221	..	4 10 6
718,100	,,	,,	7	* Do. B	165–166	..	4 4 4
306,083	,,	June 29	4	Do. Deb. Stk.	104–106	..	3 15 6
75,000	5	June 29	6	Malta & Mediterranean.	4⅛–4⅜	..	6 4 8
560,000	100	Apl. 1	5	Met. of 5 p.c. Deb.	100–102	..	4 18 0
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	100–102	..	4 8 3
541,920	20	May 27	3⅜	Monte Video, Ltd.	12½–13	..	5 7 8
1,775,892	Stk.	July 28	4⅜	Newc'tle & G'tesh'd Con	101–102	..	4 5 9
529,435	Stk.	June 29	3⅜	Do. 3½ p.c. Deb.	90–91	..	3 16 11
55,940	10	Feb. 25	7	North Middlesex 7 p.c.	133–133⅜	..	5 1 10
300,000	Stk.	Apl. 29	8	Oriental, Ltd.	138–140	..	5 14 4
60,000	5	Apl. 1	8	Ottoman, Ltd.	6⅛–6½	..	6 3 1
31,800	53	Feb. 25	13	Portsea Island A.	134–136	..	5 1 0
60,000	50	,,	13	Do. B.	126–128	..	5 1 7
100,000	50	,,	12	Do. C.	119–121	..	4 19 2
114,800	50	,,	10	Do. D and E.	100–102	..	4 18 0
398,490	5	Apl. 29	7	Primitiva Ord.	7 1/16–7 1/8	..	4 14 1
796,980	5	June 29	5	Do. 5 p.c. Pref.	5⅛–5⅜	+1/16	4 13 0
488,900	100	June 1	4	Do. 4 p.c. Deb.	97–99	..	4 0 10
312,650	Stk.	June 29	4	River Plate 4 p.c. Deb.	97–99	..	4 0 10
250,000	10	Apl. 1	9	San Paulo, Ltd.	15⅝–16⅛	..	5 10 9
62,500	10	,,	6	Do. 6 p.c. Pref.	11⅞–12⅛	..	4 18 0
125,000	50	July 1	5	Do. 5 p.c. Deb.	51–52	+1⅛	4 16 2
135,000	Stk.	Mar. 16	10	Sheffield A	234–236	..	4 4 9
209,984	,,	,,	10	Do. B	234–236	..	4 4 9
523,500	,,	,,	10	Do. C	234–236	+1	4 4 9
70,000	10	May 27	7	South African	11–11⅛	..	6 1 9
6,429,895	Stk.	Aug. 12	5/9/4	South Met., 4 p.c. Ord.	120–122*	..	4 9 7
1,895,445	,,	July 14	3	Do. 3 p.c. Deb.	79–81	..	3 14 1
209,820	Stk.	Mar. 16	8	South Shields Con. Stk.	157–158	..	5 1 3
605,000	Stk.	Aug. 12	5⅜	S'th Suburb'n Ord. 5 p.c.	120–122*	+1	4 12 9
60,000	,,	,,	5	Do. 5 p.c. Pref.	120–122*	+1	4 2 0
117,058	,,	July 14	5	Do. 5 p.c. Deb. Stk.	121–123	+1	4 1 4
502,310	Stk.	May 12	5	Southampton Ord.	110–112	..	4 9 3
120,000	Stk.	Aug. 12	7	Tottenham A 5 p.c.	136–138*	..	5 1 5
483,940	,,	,,	5⅜	and B 3½ p.c.	111–113*	..	4 17 4
149,470	,,	June 29	4	Edmonton 4 p.c. Deb.	57–99	..	4 0 10
182,380	10	June 10	8	Tuscan, Ltd.	9–9⅛	..	8 8 6
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	97–99	..	5 1 0
236,476	Stk.	Feb. 25	5	Tynemouth, 5 p c max.	113–115	..	4 6 11
255,636	Stk.	Feb. 25	6⅜†	Wands- B 3½ p.c.	139–141	..	4 15 9
85,765	,,	June 29	3	worth 3p.c. Deb. Stk.	73–75	..	4 0 0

Prices marked * are "Ex div." † Next dividend will be at this rate.

plumbers throughout the city for the fitting-up of the fires under the supervision of the Gas Department.

The Forres Gaslight Company, Limited, have paid a dividend of 5 per cent. for the past year.

In another part of the "JOURNAL" will be found an account of a legal process between rival patentees of apparatus for the production of power gas. We do not know anything about the processes, and indeed the one party does not seem to know much about the process of the other, for the purpose of the litigation was to keep the process of the complainers from the knowledge of the others. But the fact that the parties consider their properties worth protecting by law is an indication that there is something of value in the production of power gas. When we consider what is being said in journalism this week about the propulsion of war vessels by means of power gas, the proposition is self-evident—that power-gas plant may in the near future become a most valuable possession.

Mr. John Smith is to take over the duties of Gas Manager at Stirling on Monday. On Tuesday evening last, he entertained the members of the gas-works staff and friends at Dumfries at dinner. In the course of the evening, Treasurer Wyper, in the name of the staff and others in Dumfries, presented Mr. Smith with a barometer and a pair of framed engravings, as a token of esteem and an earnest of their good wishes for his success in his new sphere. Mr. Smith returned thanks for the unlooked-for presentation, and expressed regret at his severance from the many friends he had met with in Dumfries.

CURRENT SALES OF GAS PRODUCTS.

Sulphate of Ammonia. LIVERPOOL, *Aug.* 27.

There has again been an active market during the past week, and all parcels offered have been eagerly competed for at still hardening values. New business direct from consumers has, however, been rather scarce, and the bulk of the buying has been for the covering of sales made by dealers previously. The closing quotations are £12 3s. 9d. to £12 5s. per ton f.o.b. Hull, £12 5s. to £12 6s. 3d. per ton f.o.b. Liverpool, and £12 7s. 6d. to £12 8s. 9d. per ton f.o.b. Leith. Although there has been some inquiry in the forward position, few first-hand sales have transpired; but it is reported that £12 7s. 6d. per ton was paid for delivery f.o.b. Leith over the early months of next year.

Nitrate of Soda.

The position of this article has become firmer; and the prices on spot have been advanced to 9s. 4½d. and 9s. 7½d. per cwt. for ordinary and refined qualities respectively.

Tar Products. LONDON, *Aug.* 29.

The market for tar products has been very steady during the past week. Pitch has been very firm, and there has been a considerable inquiry for forward delivery. Creosote remains steady. In benzols, there is a fair amount of inquiry for forward delivery, and manufacturers are firm in their ideas of price. Solvent naphtha remains about the same; but there is not a great amount of new business. Crude carbolic acid is still of very little interest.

The average values during the week were: Tar, 18s. 3d. to 22s. 3d., *ex* works. Pitch, London, 37s. to 37s. 6d.; east coast, 37s. to 37s. 6d.; west coast, 35s. 6d. to 36s. f.a.s. Mersey ports. Benzol, 90 per cent., casks included, London, 6⅞d. to 7d.; North, 6d. to 6½d.; 50-90 per cent., casks included, London, 7¾d.; North, 7d. to 7½d. Toluol, casks included, London, 10d.; North, 9d. to 9½d. Crude naphtha, in bulk, London, 3½d. to 4d.; North, 3¼d. to 3½d.; solvent naphtha, casks included, London, 1s. 2d. to 1s. 3d.; North, 1s. 2d. to 1s. 3d.; heavy naphtha, casks included, London, 11d. to 1s.; North, 10d. to 11d. Creosote, in bulk, London, 2⅛d. to 2⅜d.; North, 2d. to 2¼d. Heavy oils, in bulk, 2⅜d. to 2⅝d. Carbolic acid, 60 per cent., casks included, west coast, 1s.; east coast, 1s. 0½d. Naphthalene, £4 10s. to £8 10s.; salts, 40s. to 42s. 6d., bags included. Anthracene, "A" quality, 1½d. per unit, packages included and delivered.

Sulphate of Ammonia.

The market for this article is decidedly firm; and in some quarters the prices have improved slightly. To-day, Beckton prompt is quoted at £11 15s. to £11 16s. 3d. Outside London makes are £11; Hull, £12 3s. 9d.; Liverpool, £12 2s. 6d.; Leith, £12 7s. 6d.; and Middlesbrough, £12 3s. 9d.

COAL TRADE REPORTS.

Northern Coal Trade.

There is a steady demand for coals, and the output is at the present time ample; so that the shipments are heavy, both of steam and gas coals. In steams, the tone of the market is quiet. Best Northumbrians are 9s. 10d. to 10s. per ton f.o.b., second-class steams about 9s., and steam smalls from 5s. 6d. to 6s. 9d., according to quality. This market still seems to feel the loss of contracts diverted to other coalfields at the time of the stoppages in Northumberland in the spring. In gas coals, there is now a steady increase in the home consumption, so that the deliveries on the long contracts are being enlarged; and there is also a fairly good export. The production is, however, heavy, and meets the needs readily. Durham gas coals vary in price. The usual classes are from 9s. to 9s. 10½d. per ton f.o.b., according to quality; and "Wear" specials are from 10s. 4½d. to 10s. 6d. As to contracts, there has been the settlement of these over the winter and next year—some 38,000 tons—for Palermo, at about 9s. 9d. per ton f.o.b. A Danish company has also bought 20,000 to 25,000 tons of best gas coals, delivered at Marriagerford; and the price is said to be 14s. per ton. Other contracts are now in course of negotiation. As to coke, the market is generally steady; but the increasing output of gas

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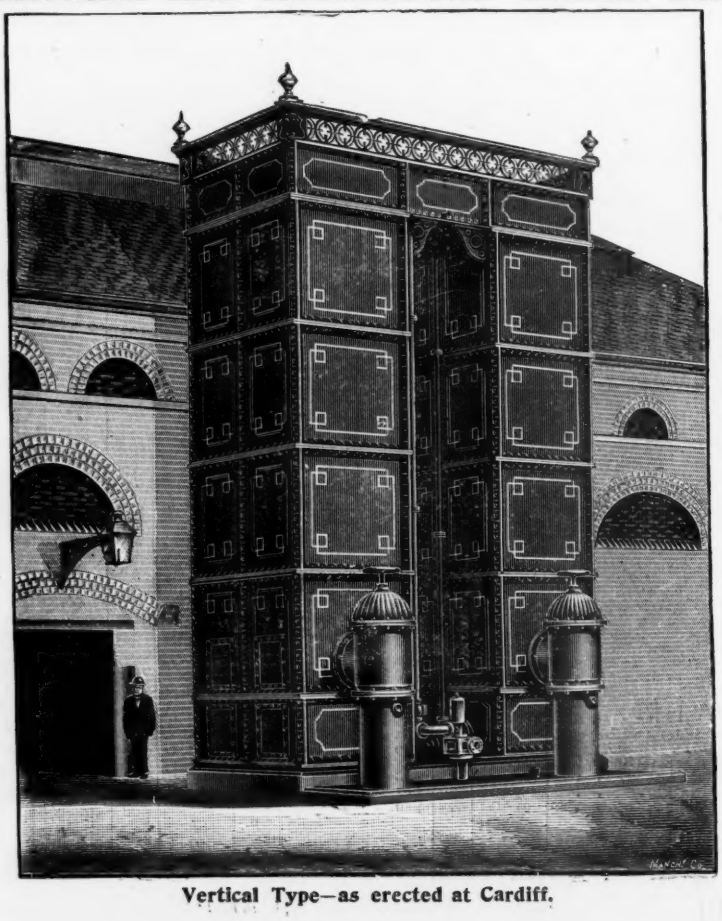

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PERNAMBUCO,
WELLINGBOROUGH,
NEW MILLS,
SNYDALE,
MIDDLESBROUGH,
ETRURIA,
NORWICH,
EAST HULL,
KINGSTON-ON-THAMES,
BRISTOL,
WALKER AND WALLSEND,
and other Works.

coke makes it easier. Good gas coke is quoted from 15s. to 15s. 6d. per ton f.o.b., according to time of delivery.

Scotch Coal Trade.

Trade is still slow; the foreign demand being poor, and with little prospect of improvement. There is a growing feeling among coal-owners in favour of a movement for the reduction of the minimum wage paid to miners, which, it is felt, is too high when account is taken of the prices obtainable for coal. The prices now quoted are: Ell, 8s. 9d. to 10s. per ton f.o.b. Glasgow; splint, 9s. 3d. to 9s. 6d.; and steam, 9s. to 9s. 3d. The shipments for the week amounted to 340,091 tons—a decrease of 6014 tons upon the previous week, and of 22,245 tons upon the corresponding week of last year. For the year to date, the total shipments have been 10,298,323 tons—an increase of 910,027 tons upon the corresponding period.

Position of the St. David's Water and Gas Company.

The application by a debenture-holder for the appointment of a Receiver and Manager, which was made to the Vacation Judge (Sir Samuel Evans) on the 17th inst. (see *ante*, p. 329), was renewed last Wednesday. Counsel stated that the Secretary of the Company had now made an affidavit from which it appeared that the revenues were gradually increasing. On the last occasion, his Lordship raised the question whether he had jurisdiction to appoint a Manager of a statutory undertaking. Having considered the matter, Counsel said he could not ask the Court to appoint one; all he asked for was the appointment of a Receiver. His Lordship inquired how the inhabitants of St. David's would get their water; and Counsel replied that the Receiver would have power to make a subsequent application to the Court to enable further money to be raised so as to carry on the business of the Company. His Lordship appointed a Receiver, and directed that he should be at liberty to act forthwith.

Reduction in Price at Blyth and Cowpen.—At the half-yearly meeting of the Blyth and Cowpen Gas Company, the Chairman (Mr. William Thompson) said the profit and loss account showed a balance of £7948 available for appropriation; and the Directors felt justified in recommending that a dividend be paid at the rate of £3 7s. 6d. per cent., less income-tax. The payment of this dividend on the £65,704 capital of the Company would absorb a sum of £2086, leaving the comfortable sum of £5862 as a floating working balance. The quantity of gas made had been 54,286,000 cubic feet, an increase of 1,414,000 feet when compared with the corresponding period of last year. The financial position being so favourable, the Board had carefully considered the question of the charge for gas, and had decided that the price should be reduced 2d. per 1000 cubic feet. This reduction would apply to all consumers, and make the price 2s. 8d. per 1000 feet.

Unpleasant Experience of Mr. J. H. Brown, of Nottingham.

Mr. J. H. Brown, the Engineer and General Manager of the Nottingham Corporation Gas Department, who returned last Sunday from a motor cycle tour in France and Germany, had an unpleasant experience at Metz, where he was arrested as an English spy. He told a "Daily Chronicle" representative on Sunday night that he travelled ten days ago (*viâ* Boulogne and Paris) to Switzerland, and on Friday last commenced his return journey by riding from Basle through the Black Forest to Metz. He arrived in the German frontier town about seven in the evening, and, anxious to complete his journey quickly to attend a farewell service to a local minister at the Albert Hall, he entered a café and secured a guide. He then inquired as to the quickest way of reaching England, and chose a roundabout route by which he could join a train reaching Calais sooner than the ordinary express *viâ* Paris. This circumstance, combined with his travel-stained and torn garments, aroused suspicion; and suddenly two police officers appeared and placed him under arrest on suspicion of being an English spy. "So insolent were they," said Mr. Brown, "that had any policeman in England done half I should have hit him in the jaw. I told them as much, and it made them very cross. At the police station they searched every paper I had, demanded an explanation of a tear I had in my clothes, why I had travelled so fast, why I wanted to get back to England in such a hurry, and were suspicious of every little circumstance to a most ludicrous degree. After keeping me for six hours while they made every possible inquiry about me, I was liberated at two o'clock on Saturday morning."

Bristol Public Lighting.—During the last financial year, the Gas Lighting Department of the Bristol Corporation spent £23,355, which is equivalent to a rate of 3·55d. in the pound. The gas supplied cost £10,641, and £8021 was paid for wages. Electric lighting cost £12,026; representing 1·83d. in the pound.

Reduction in Price at Barking.—Presiding at the half-yearly meeting of the Barking Gas Company last Wednesday, at which a very satisfactory statement of accounts was presented, Mr. A. E. Humphreys-Owen expressed his pleasure at being able to place before the shareholders such evidence of continued prosperity, and also to announce that the price of gas had been reduced to 2s. 11d. per 1000 cubic feet. Maximum dividends were declared on each class of shares; and a hearty vote of thanks was accorded to the Directors and officials.

Improved Public Lighting at Launceston.—At their last meeting, the Launceston Town Council accepted a tender by the Gas Company for the lighting of the lamps. Mr. Proctor said they were to pay 3s. 3d. per 1000 cubic feet for all the gas consumed, and in addition the cost of lighting and extinguishing, £95. Mr. Hicks remarked that they hoped to save by the introduction of the new system of incandescent lighting. Some of the old lamps which had been dispensed with were a disgrace to the town. They had put up new lanterns and incandescent burners in their place.

USE FOR COOKING OR HEATING A
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GAS STOVE OR FIRE FROM ALL GAS COMPANIES
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The EVER-INCREASING POPULARITY of the

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Has led to this old-established firm having to use Motor Lorries to cope with their present demand. ¶ The above illustration depicts three of the "Main" Lorries ready to start the day's deliveries, and to give an instance of the enterprise shown by this firm, Lorries Nos. 5 and 6 were actually constructed throughout at their Gothic Works, Edmonton. ¶ Full particulars of this firm's specialities will be sent on receipt of a post-card addressed to

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Increase of Population in London Suburbs.

According to the recently issued annual report of the Medical Officer of Health for the County of Middlesex, the population of the county has risen from 792,314 at the time of the Census of 1901 to 1,123,328 at the end of June last year, or an increase of 331,014. The following figures show the extent of the growth in certain of the districts:—

District.	1901.		1909.
Acton	37,744	..	56,000
Chiswick	29,809	..	37,059
Ealing	33,031	..	52,550
Edmonton	44,911	..	61,164
Enfield	42,738	..	57,453
Finchley	22,126	..	41,627
Hendon	21,685	..	34,219
Heston and Isleworth	30,863	..	35,672
Hornsey	72,056	..	92,839
Tottenham	102,541	..	149,283
Willesden	114,811	..	150,145

It will be noticed that the population of Finchley has almost doubled; while increases of 50 per cent. have taken place in Hendon and Ealing. This necessarily means greatly increased business for the respective gas companies.

Enfield Gas Company.—At the half-yearly meeting of the Company to-day, the Directors will report that the balance of gross profit amounts to £6111, which sum is reduced by the net interest charges to £5495. They have transferred £875 to the credit of the reserve fund and £690 to the credit of the insurance fund; leaving £3930 available for distribution. They recommend a dividend at the rate of 5½ per cent. per annum on the consolidated ordinary stock (less income-tax), leaving £15 to add to the undivided profit previously accrued, augmenting this fund to £11,334.

Barnsley Gas Company.—Moving the adoption of the report and accounts at the annual meeting of the Barnsley Gas Company, the Chairman (Mr. E. G. Lancaster, J.P.) remarked that the Board were committed to a serious expenditure in connection with the provision of a new system of retorts, which they were advised would be more economical, and would relieve stokers of a good deal of hard work which they now had to do. The balance-sheet showed, after paying full dividends, a margin of £449. They had always promised, as soon as possible to return to the old system of discounts for prompt payment. They thought they would now be able to do this; and the discount they proposed, on the basis of last year's figure, would amount to £630. Some might think it was rash to give so much, with a margin of £449; but they would take the small risk, hoping, if the new retorts produced the expected result, that in the course of a few years they would not only be able to give the contemplated 2½ per cent. discount, but to increase it. The balance carried to profit and loss account was £8359, against £7788 the previous year; and this result was produced by reduced working expenses and the sale of more gas.

Quality of Portsmouth Water.—The Medical Officer of Health for Portsmouth has reported to the Corporation that the whole of the water supplied by the Portsmouth Water Company is being filtered; that the quality of the water is now second to none in the kingdom; and that its sparkling character is maintained, contrary to the opinion entertained by many that it would be destroyed by the filtration system in use.

Aberystwyth Gas Company.—In the report of this Company, of which Mr. Henry Woodall is the Managing-Director, for the half year ended the 30th of June last, the Directors express their pleasure in recording the continued success of the undertaking. The growth in the sale of gas, compared with the corresponding period of 1909, was at the rate of 4 per cent.; and the loss from leakage was reduced by 440,000 cubic feet. In compliance with a resolution passed at the annual meeting in February, the August meeting is discontinued; but the Directors have decided to pay the usual dividends at the rates of 12¾ per cent. per annum on the original shares and £8 18s. 6d. per cent. per annum on the new shares, both less income-tax.

Position of the British Coalite Company.—A rumour having been in circulation that the British Coalite Company have closed down a portion of their works, a representative of the "Financial News" made inquiries at the Company's office, and was informed that this was the case. The following remarks appeared in our contemporary yesterday: "The rumour was taken as indicating a serious state of affairs; but officially it is said to do the reverse. A Managing-Director has been appointed, and this gentleman informed our representative that the staff is being reorganized to a certain extent, and that the plant is being put into shape for working on more continuous lines. That portion of the plant which is erected at Wednesfield, therefore, has been closed-down; but, on the other hand, the Company is starting up at Barking; 'so that,' said the Managing-Director, 'there is really not much truth in the rumour. It is rather favourable than otherwise.'"

Magistrate as Gas Shareholder.—At the Old Street Police Court last Friday, Alfred Watt, a carman, was charged with stealing from a prepayment gas-meter 8s. 2d., the moneys of the Gaslight and Coke Company. When the charge was called, Mr. Cluer, the Magistrate, remarked that he was unable to decide the case, which must either go to the Sessions after the evidence had been heard or be put back for another Magistrate to hear. He regretted that the time and money of both the Company and the Courts should be wasted in this manner, but he personally was powerless, as he held, as trustee, some shares in the old West Ham Gas Company, which had been absorbed by the prosecuting Company. Some time since, at considerable loss, he had been compelled to dispose of some shares he had held in the latter Company, as the law with regard to a Magistrate having an interest in any company or undertaking connected with a charge before him was very explicit. The evidence showed that the prisoner had been employed to move some tenants from a house in Great Chart Street, and, during their temporary absence, he had broken open the gas-meter. The accused was remanded.

The "SUN" Boiler.

The "SUN" is constructed on accurate scientific principles—all tending to ensure maximum effectiveness with a minimum gas consumption.

The "SUN" has a most important virtue—viz., a perfect working, non-capsule Thermostat—which prevents any delay and loss of efficiency in heating up the water.

And one more, hardly less in importance—Boiler and Tank in one, and right over the Burner—thus saving loss of heat in circulation, when hot water is not being drawn off.

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241.

Sale of Shares.—Mr. A. W. Tyrrell recently offered for sale, at the Red Lion Hotel, Basingstoke, £922 of consolidated ordinary 5 per cent. stock of the Basingstoke Gas Company. The £100 lots fetched prices varying from £106 to £104; the £50 lots were sold at from £53 to £52; the £25 lots realized from £26 to £25 10s.; and the remaining £22 of stock was sold for £23.

The Price of Gas at Bolton.—The Gas Committee of the Bolton Corporation, at their meeting last Friday, had again under consideration the question of the price of gas to consumers with prepayment meters. It was decided to re-affirm the resolution passed in the early part of July, fixing the charge at 1d. per 27 cubic feet. The local Trades Council had by deputation urged upon the Committee to give 30 cubic feet; but a resolution to this effect was defeated by a large majority at the last meeting of the Town Council.

Winchester Gas and Water Supply.—At the meeting of the Winchester Water and Gas Company last Friday, the Directors reported that the receipts from the sale of gas and water continued to be satisfactory. The balance of net revenue available for distribution was £5538; and the Directors recommended the payment of dividends on the preference and consolidated ordinary stock at the rate of 4 per cent. per annum, less income-tax, for the half year ended the 30th of June. The Directors mentioned that the Bill promoted by the South Hants Water Company had received the Royal Assent; and they expressed their pleasure in reporting that the protecting clauses which they were advised to require, had been accepted and incorporated in the Act. The Engineer and General Manager (Mr. H. C. Head) reported that all the Company's plant had been maintained in efficient condition.

New Joint-Stock Companies Registered.—A private Company, having the title of Duckham and Cloudsley, Limited, has been registered with a capital of £5000, in £1 shares, to acquire from Woodall and Duckham, Limited, an exclusive licence to use and vend certain existing inventions in relation to the carbonization of coal and other matters; also to acquire any information or rights relating to the production, treatment, storage, distribution, and use of gas, &c. The first Directors are A. M. Duckham and J. L. Cloudsley (both permanent). The registered office is at Palace Chambers, Westminster, S.W. The Oundle Gaslight and Coke Company (1910), Limited, has been registered with a capital of £4000 in £5 shares, to take over the business of the Oundle Gaslight and Coke Company. The Company has been registered without Articles of Association.

A project is on foot for laying a water-main 9½ miles long in Eger (Hungary). The cost of the work is estimated at 2,000,000 kronen, or about £83,300.

At Goring-on-Sea (Sussex), the Parish Council have determined to recommend to a parish meeting a lighting scheme for the parish, which will entail a charge upon land of 1½d., and on buildings of 4½d., in the pound.

The Directors of Messrs. Stewarts and Lloyds, Limited, have declared the following interim dividends for the half year ended the 30th of June: At the rate of 6 per cent. per annum on the preference shares; and at the rate of 10 per cent. per annum on the preferred ordinary shares.

At a Local Government Board inquiry, which was held consequent upon an application by the Wath-upon-Dearne and Bolton Gas Board for sanction to borrow £17,296, it was stated that the total profit of the recently acquired undertaking for the fifteen months to March, 1910, amounted to over £3000. It was further explained that gas was sold at from 3s. 2d. to 3s. 9d. per 1000 cubic feet. The amount of the proposed loan included £2296 for land; the remainder of the money required being for plant, mains, services, &c.

APPLICATIONS FOR LETTERS PATENT.

19,129.—ZAHN, O., "Gas-furnaces." Aug. 15.
19,155.—DR. C. OTTO AND CO., G. M. B. H., "Treating distillation gases for the recovery of tar and ammonia." Aug. 15.
19,175.—PATSCHKE, A., "Gas-turbine." Aug. 15.
19,181.—SCHACHTEL, H., "Production of combustible gas." Aug. 15.
19,197.—WILLIAMS, B., "Combined coke quencher and conveyor." Aug. 15.
19,207.—CHANDLER, S., and ROBERT CORT AND SON, LTD., "Gas apparatus." Aug. 16.
19,218.—KELLY, J. T., "Pipe-unions." Aug. 16.
19,246.—ZECHNALL, L., "Bunsen burners." Aug. 16.
19,262.—DRABBLE, H., "Gas rings or burners." Aug. 16.
19,292.—COVENTRY, W., "Inverted burners." Aug. 17.
19,375.—JACKSON, J. P., "Gasometers." Aug. 18.
19,382.—SADLER, H. S., and ASHMORE, BENSON, PEASE, AND CO., LTD., "Purification of gas." Aug. 18.
19,414.—HANDS, G., and TURNER, F., "Inverted burners." Aug. 18.
19,419.—ANDERSON, D., "Controllers for gas." Aug. 18.
19,420.—ANDERSON, D., "Gas-lamps." Aug. 18.
19,421.—ANDERSON, D., "Cocks for gas." Aug. 18.
19,422.—PIGGOTT, F., "Artificial fuel." Aug. 18.
19,429.—SPROTT, E. W., "Pipe-connectors." Aug. 18.
19,443.—KOENIG, J., "Pipe-joints." Aug. 19.
19,488.—FLORY, T. W., "Gas hot-plates." Aug. 19.
19,524.—BLAKEY, J. W., A. G., & J., "Gas-burner." Aug. 20.
19,552.—DR. C. OTTO AND CO., G. M. B. H., "Obtaining directly ammonia from hot tar-free gases of distillation." Aug. 20.
19,555.—LALIBERTE, A. J., "Mixtures for increasing combustion." Aug. 20.
19,564.—SAVORY, C. B., "Ascertaining the specific gravity of fluids and vapours." Aug. 20.

Wait and See.

OUR New Season's Gas Fires, like the Incandescent Mantle, will create a new era in the Gas World.

A HIGHLY SCIENTIFIC FUEL, or patented construction, will also be a feature of our Winter Campaign.

RADIATORS have come in for an equal share of attention. Radical improvements have been effected, and an entirely new departure has been introduced.

Full details will be placed before the Gas Engineers of the Kingdom very shortly. Each item will excel in the matter of

MAINTENANCE.

MANCHESTER Show-Rooms: Victoria Arcade Deansgate.

LONDON Show-Rooms: 59, Queen Victoria St., City.

DAVIS Gas Stove Co., Ltd., LUTON.

The Directors of the Imperial Continental Gas Association recommend a dividend of 4½ per cent., less income-tax, for the half year ended the 30th of June, compared with 4 per cent., free of income-tax, for each of the eight preceding half years.

A dividend of 5 per cent. and a bonus of 2s. 6d. per share are recommended by the Directors of the British Gaslight Company, Limited, for the half year ended June 30. This time last year a similar dividend was announced; but there was no bonus.

We have received from the Bland Light Syndicate, Limited, their catalogue for 1910-11. It consists of 56 quarto pages, in which are shown the newest types of their inverted burners, suitable for ordinary church, factory, and workshop lighting. There is also presented a very large collection of artistic globes, shades, and fittings, and lobby and outdoor lamps; a page being devoted to the "Blanlite" regenerative lamps for street lighting. Particulars are given of plant for high-pressure lighting, as well as of the "Telephos" distance lighters and accessories for Bland burners. On the front page of the wrapper is an effective representation of a Bland three-light pendant; the back page having as its centre-piece a reproduction of a photograph of what is called "a famous Eastern building" lighted entirely by Bland burners and "Blanlite" lamps. The place is not mentioned; but it is one where, notwithstanding the poet's assertion, "East meets West"—the Bland light being the connecting-link.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situation Vacant.

DRAUGHTSMEN. No. 5268.

Situations Wanted.

GAS ENGINEER AND MANAGER. (Abroad). No. 5275.
ENGINEER, MANAGER, OR HEAD DRAUGHTSMAN. No. 5277.
METER INSPECTOR AND COLLECTOR. "Competent," Wellingborough.

Plant for Disposal.

FILTER PRESS. Sutton (Surrey) Gas Company.

Sale of Gas Stock.

WESTON-SUPER-MARE GASLIGHT COMPANY. Sept. 20.

TENDERS FOR

Collecting Works and Conduit.

BAKU WATER-WORKS. Tenders by 14/27th October.

Coal.

RAWMARSH URBAN DISTRICT COUNCIL. Tenders by Sept. 10.

Coke.

RAMSGATE CORPORATION. Tenders by Sept. 12.

Lime.

STAINES AND EGHAM GAS COMPANY. Tenders by Sept. 9.

Tar and Liquor.

STAINES AND EGHAM GAS COMPANY. Tenders by Sept. 9.

Tar.

PADIHAM URBAN DISTRICT COUNCIL. Tenders by Sept. 7.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

United Kingdom: One Year, 21s.; Half Year, 10s. 6d.; Quarter, 6s. 6d.
Payable in advance. If credit is taken, the charge is 25s. a year.
Abroad (in the Postal Union): £1 7s. 6d., payable in advance.

All Communications, Remittances, &c., to be addressed to
WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.
Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

OXIDE OF IRON.

O'NEILL'S OXIDE
For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE.

SPENT OXIDE PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LD.,
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C.

WINKELMANN'S
"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 183, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

BROTHERTON & CO., LIMITED.
Offices: City Chambers, LEEDS.
Correspondence invited.

LUX'S GAS PURIFYING MASS.
See Advertisement on First White Page.
FRIEDRICH LUX, LUDWIGSHAFEN-AM-RHEIN.

READ HOLLIDAY AND SONS, LTD.,
HUDDERSFIELD,
Are prepared to Supply
BENZOL, TOLUOLE, NAPHTHA, AND CREOSOTE
in large Quantities.

ENQUIRIES SOLICITED.

BRISTOL RECORDING GAUGES AND THERMOMETERS.

J. W. & C. J. PHILLIPS, 23, COLLEGE HILL, LONDON, E.C., and 25, BRIDGE END, LEEDS.

AMMONIACAL Liquor wanted.
CHANCE AND HUNT, LTD., Chemical Manufacturers, OLDBURY, WORCS.
Telegrams: "CHEMICALS."

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 54 & 47, Westminster Bridge Road, LONDON, S.E.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS, AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 815 Oldham, and 2412 Hop, London.
Telegrams:—
"BRADDOCK, OLDHAM," and "METRIQUE, LONDON."

OXIDE OF IRON (BOG ORE).

ANY QUANTITY. ANY PORT. ANY STATION.

DONALD M'INTOSH,
110, CANNON STREET, LONDON.

DUTCH OXIDE OF IRON.

SPENT OXIDE PURCHASED IN ANY DISTRICT.

THE First Dutch Bogore Co., Ltd.,
NYMEGEN, HOLLAND.
General Manager (for England and Wales)—
CHARLES E. FRY, SUTTON, SURREY.
General Manager (for Scotland)—
J. B. MACDERMOTT, 11, Bothwell St., GLASGOW.

AMMONIACAL Liquor wanted.
BROTHERTON AND CO., LTD., Ammonia Distillers. Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, SUNDERLAND, AND WAKEFIELD.

M.H. (Methane Hydrogen) **GAS PLANT, LTD.,**
19, GREAT WINCHESTER STREET, LONDON, E.C.
The M.H. GAS PLANT produces at will:—
METHANE HYDROGEN GAS from Coke, Tar, Steam, and either Benzol or Tar enrichment.
BLUE WATER GAS from Coke and Steam.
CARBURETTED WATER GAS from Coke, Steam, and any Crude Oil.

GAS-WORKS requiring Extensions should Communicate with FIRTH BLAKELEY, SONS, AND CO., LIMITED, Dewsbury, who make a Speciality of Catering for the Smaller Gas Concerns. Prices Reasonable; quality and results, the *best*. Satisfaction Guaranteed.

SULPHATE OF AMMONIA
SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.
We guarantee promptness, with efficiency for Repairs.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.
Telegrams: SATURATORS, BOLTON. Telephone 0848.

OXIDE OF IRON.
(NATURAL.)
SPENT OXIDE PURCHASED.
BALE'S FIRE CEMENT.
PAINT FOR GAS-WORKS.

BALE & CHURCH,
5, CROOKED LANE, LONDON, E.C.

SULPHURIC ACID.

SPECIALLY prepared for the Manufacture of SULPHATE OF AMMONIA.
SPENCER CHAPMAN & MESSEL, LTD.
with which is amalgamated WM. PEARCE & SONS, LTD.
86, Mark Lane, LONDON, E.C. Works: SILVERTOWN.
Telegrams: "HYDROCHLORIC, LONDON."
Telephone: 341 AVENUE.

JOHN W. LEITCH AND COMPANY,
MILNSBRIDGE CHEMICAL WORKS,
near HUDDERSFIELD.
The Manufacture of
PURE BENZOL FOR GAS ENRICHMENT
a speciality.

J. E. C. LORD, Ship Canal Tar Works, Weaste, Manchester. Pitch, Creosote, Benzols, Toluol, Naphtha, Pyridine, all kinds of Cresylic Acid, Carbolic Acid, Sulphate of Ammonia, &c.

SULPHURIC ACID.

SPECIALLY prepared for Sulphate of AMMONIA Makers by
CHANCE AND HUNT, LIMITED,
Works: OLDBURY, WEDNESBURY, AND STAFFORD.
Address Correspondence and Inquiries to OLDBURY, WORCS.
Telegrams: "CHEMICALS, OLDBURY."

ROBERT DEMPSTER & SONS, Ltd.,
Contractors for Complete CARBONIZING PLANTS and every description of GAS APPARATUS and ELEVATING and CONVEYING PLANT, Rose Mount Iron-Works, Elland.

TAR WANTED.
Telephone: Central Manchester, 7002.
Telegrams: "UPRIGHT."
Apply, THOMAS HORROCKS,
Albert Chemical Works, BRADFORD, MANCHESTER.
Pitch, Creosote, Brick and Fuel Oils, Benzol, Solvent Naphtha, Carbolic, Sulphate of Ammonia.

AMMONIA Waste Liquor Disposal.
Purification Plant.
Results Guaranteed. No Working Costs.
John Radcliffe, Chemical Engineer, East Barnet.

"GAZINE" (Registered in England and Abroad). A radical Solvent and Preventative of Naphthalene Deposits, and for the Automatic Cleaning of Mains and Services.
It is also used for the enrichment of Gas.
Manufactured and supplied by C. Bourne, West Moor Chemical Works, Killingworth, or through his Agent, F. J. Nicol, Pilgrim House, Newcastle-on-Tyne.
Telegrams: "Doric," Newcastle-on-Tyne. National Telephone No. 2497.

AMMONIA.
Consumers in any form are invited to correspond with Chance and Hunt, Ltd., Chemical Manufacturers, Oldbury, Worcs.

D. ANDERSON AND COMPANY,
GAS LIGHTING ENGINEERS AND CONTRACTORS,
18 & 20, FARRINGDON ROAD, LONDON, E.C.
Telegrams: "Dacolight London," Telephone: 2896 Holborn.

PATENTS AND TRADE MARKS
PUBLICATIONS, "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; "SUBJECT-MATTER of PATENTS," 6d.
MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 & 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

SULPHURIC ACID for Sale, specially suitable for making Sulphate of Ammonia.
Brotherton and Co., Ltd., Chemical Manufacturers, Works: Birmingham, Leeds, Sunderland, and Wakefield.

GAS OILS.
MEADE-KING, ROBINSON, & CO.
Represent the Strongest Independent Refineries in America; also Petroleum Spirit for Gas Enrichment. 18, Exchange Street, Manchester, and 11, Old Hall Street, Liverpool.

HYDRATED OXIDE OF IRON.
PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no back Pressure.
The Cheapest in the Market.
Read Holliday and Sons, Ltd., Huddersfield.

IT is Worth Your While to Buy Direct.
The RELIANCE LUBRICATING OIL COMPANY supply the best value in NON-CORROSIVE LUBRICANTS—viz, Motor Waggon Oil, 1s.; Motor Car Oil, 2s.; Engine, Cylinder, and Machinery Oils, 1s.; Axle Oil, 10½d; Exhauster Oil, 10d.; Special Cylinder Oil, 1s. 4d.; 650 T Cylinder, 2s.; Special Engine Oil, 1s. 4d.; Gas Engine and Oil Engine Oil, 1s. 6d.; Refrigerator, 1s. 9d.; Renown Engine Oil, 11½d.; and Astral Disinfectant, 2s. 6d. per gallon. Barrels free, carriage paid. Solidified Oil, 25s. cwt.
The Reliance Lubricating Oil Company, 19 & 20, Water Lane, Tower Street, London, E.C.

KRAMERS AND AARTS WATER-GAS PLANT.
K. & A. WATER-GAS COMPANY, LTD.
89, VICTORIA STREET, S.W.

"HALLITE" Asbestos High-Pressure Sheeting.
Hallite Douglas, Limited, 106, Leadenhall Street, London, E.C.

SPENCER'S PATENT HURDLE GRIDS.
THE very best Patent Grids for Holding Oxide Lightly.
See Illustrated Advertisement, Aug. 23, p. 548.

GAS TAR wanted,
Brotherton and Co., Ltd., Tar Distillers, Works: Birmingham, Glasgow, Leeds, Liverpool, Sunderland, and Wakefield.

THE UNIVERSITY OF LEEDS.

DEPARTMENTS OF COAL GAS, FUEL, AND METALLURGY, AND ELECTRICAL, CIVIL, MECHANICAL, AND MINING ENGINEERING.

THE Work of these Departments is carried on in separate Blocks of Buildings specially equipped for Systematic Instruction.
Prospectus may be had free on Application from the Registrar.
The next Session begins on Oct. 4, 1910, on which day the Entrance Examination will be held at Ten a.m. and Two p.m.
W. F. Husband, Registrar.

GAS PLANT for Sale—We can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
Firth Blakeley, Sons, and Company, Limited, Thornhill, Dewsbury.

CORRESPONDENCE CLASSES.
GAS Engineering and Gas Supply.
City and Guilds of London Institute.
Teacher: HERBERT LEES (Silver Medallist), Assoc.M.Inst.C.E., Engineer and Manager of the Hexham Gas Company, Lecturer at Rutherford College, Newcastle-on-Tyne.
For Terms, &c., address Elvaston Road, Hexham.

JOHN RILEY & SONS, Chemical Manu- facturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 Years. References given to Gas Companies.

WARNER & VAN DER BIESEN,
ZWOLLE, HOLLAND.
Diggers and Suppliers of the
FINEST DUTCH BOG-ORE.
(Natural Oxide of Iron.)
Best Percentages. For lowest Quotations to any Port, Station, or direct into Works, please apply to—
London Offices: 6, LEATHER LANE, E.C.

CITY and Guilds Examinations in Gas Engineering and Gas Supply. Students who have done badly at the recent Examinations should join Mr. Cranfield's Correspondence Classes for next Session. Assistance ample, individual, and private.
Write at once, 11, Avondale Place, Halifax.

SATURATORS, Tanks, &c., made or Repaired. Promptness with Efficiency guaranteed. Own Plant optional. Any distance. References.
Leadburner, 118, Galloway Road, London, W.

GAS Engineer and Manager (Age 32), Experience over 17 Years in Erecting and Managing Gas-Works, desires APPOINTMENT Abroad. Would go out Erecting or Managing.
First-Class References, and any further Particulars from No. 5275, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, a Position as Engineer, MANAGER, or HEAD DRAUGHTSMAN to Gas or Water Works or Contracting Engineers. Thoroughly Competent. Energetic. Good References. Age 35 Years. Moderate Salary. No objection to going Abroad.
Address No. 5277, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

YOUNG Man, requires situation as METER INSPECTOR and COLLECTOR. Able to advise consumers, thorough knowledge of Fitting; City and Guilds Certificate. Seven Years' experience in large and small Gas-Works. Excellent references.
Address, Competent, 100, Knox Road, Wellingborough, Northants.

WANTED, immediately, Two or Three DRAUGHTSMEN, fully Experienced in the Design of Modern Gas Plant.
Apply, by letter, Stating Age, Qualifications, and Salary required, to No. 5268, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED by a Firm of Ironfounders and Chemical Engineers, with Established Trade among Chemical Manufacturers, to undertake the Sole Rights of Making and Selling Chemical Specialities in Great Britain.
Apply No. 5262, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

FOR SALE—Filter Press in Perfect Condition. Self-Contained Engine and Pump.
Apply to the Secretary, Gas Company, Sutton, Surrey.

GASHOLDERS—16 ft., 24 ft., 26 ft., and 45 ft. Diameter GASHOLDERS, Cheap for immediate Sale. Re-erected in either Brick or New Steel Tanks Complete to Plan and Specification. Can be seen Temporarily Erected at our Works.
Firth Blakeleys, Thornhill, Dewsbury.

FOR DISPOSAL—Brick Plant com- plete. Including 400,000 Place and Hard Stock BRICKS, 15s. to 25s. per Thousand f.o.r. Maidstone. 12-H.P. Portable STEAM-ENGINE by Marshall, of Gainsborough, insured 90 lbs. Steam by National, nearly as good as when delivered from Workshops, £140. High-Pressure BOILER, new, insured 200 lbs. Steam. Suitable for 2-Ton Lorry, £20. 4-H.P. Horizontal STEAM-ENGINE, £5. 5-H.P. ditto, £6. Cheap 8-H.P. Portable STEAM-ENGINE £25. Offers solicited.
Full Particulars on Application to Wm. Johnson, Junr., New Hythe, Larkfield, Kent.

PADIHAM URBAN DISTRICT COUNCIL.
(Gas Department.)

THE above Council invite Tenders for the Purchase of the Surplus TAR produced at their Gas-Works during the Twelve Months ending Sept. 30, 1911. The probable Quantity will be 360 Tons, and the Council have now direct communication from their Gas-Works to the Railway.
Sealed Tenders, endorsed "Tar," and addressed to J. C. Waddington, Esq., Clerk to the Council, to be delivered at the Council Offices, Padiham, before Twelve o'clock noon on the 7th day of September, 1910.
A. J. Harrison, Engineer and Manager.

STAINES AND EGHAM DISTRICT GAS AND COKE COMPANY, LIMITED.

LIME.

THE Directors of the above Company are prepared to receive TENDERS for the Supply of about 130 Tons of LIME, suitable for Gas Purification, during the Twelve Months ending Sept. 30, 1911.
Forms of Tender may be had on Application.

TAR AND AMMONIACAL LIQUOR.

TENDERS are invited also for the Purchase of the Surplus COAL TAR, CARBURETTED WATER-GAS TAR, AND AMMONIACAL LIQUOR, for One Year commencing on the 1st of October next.
Coal Tar, at per Gallon, pumped into Buyer's Tank-Barges alongside the Company's Thames-side Wharf at Egham.
Carburetted Water-Gas Tar, at per Gallon, pumped into Buyer's Casks and loaded on to Buyer's Barge alongside Wharf.
Ammoniacal Liquor, at per 1000 Gallons, at 8-oz., 9-oz., and 10-oz. Twaddel, pumped into Buyer's Barge, as before stated.
The Directors reserve the right to accept any Tender for Tar and Liquor separately.
The highest or any Tender not necessarily accepted.
Tenders, endorsed "Lime," "Tar," and "Liquor" respectively, and addressed to the Directors, must be delivered not later than Friday, the 9th of September next.
Geo. H. Sayers, Secretary.
The Causeway, Staines,
Aug. 20, 1910.

BAKU WATER-WORKS.
Contract No. 1.

COLLECTING WORKS AND CONDUIT.

TENDERS are invited for the Execution of the Collecting Works, consisting of 13 TUBE WELLS of 1000 mm. diameter, with a COLLECTING SYPHON of 400 mm. to 750 mm. diameter and 2245 m. in length, and of the CONDUIT to Baku, consisting of:
A MASONRY CONDUIT, 120 cm. by 170 cm., 137 kilometres in length.
Ditto., 100 and 120 cm. by 150 cm., 17 kilometres in length.
INVERTED IRON SYPHONS, 1200 mm. diameter, 10 kilometres in length.
Ditto., and PUMPING MAIN, 800 mm. diameter, 22 kilometres in length.
A TUNNEL, 810 m. in length.
With all Accessory Works, and including all Supply and Delivery of Materials.
The Plans, Sections, and Drawings, and the Specification and Bills of Quantities and Schedule of Prices, can be seen during Office hours at the **City Water-Works Office, in the Town Hall, in Baku,** and in the Office of the Engineer-in-Chief, W. H. Lindley, M.Inst.C.E., 29, Blittersdorffs Platz, Frankfurt a/M., at which Offices all further Information can be obtained.
The Specification, Bill of Quantities, and Schedule of Prices, and the Form of Tender, can be obtained at the above-named places in three copies, on payment of 21s.
A Copy of the General Design will be furnished on Application to the Uprawa (Municipal Administration) at Baku on payment of £8.
Trial Shafts have been sunk along the line and can be inspected, as well as the collection of samples taken from the same and stored at the Baku Office, where also the results of all further Examinations can be seen.
Tenders will be received either for the whole of the work or for sections of the same.
The Tenders made out on the Forms supplied, must be delivered, post paid or by hand in sealed Envelopes, at the Uprawa in Baku, not later than Noon on the 14/27th October, 1910, endorsed as follows: **"Water-Works of the City of Baku. Contract No. 1.—Tender for the Collecting Works and Conduit."**
The Tenders will, at the time above stated, be opened publicly in the presence of the Representatives of Tendering Firms.
Tenders for the whole of the work must be accompanied by a receipt from the Treasury of the City of Baku, certifying the deposit of the specified caution money to the amount of 250,000 Rbl; Tenders for sections of the work by the same to the amount of at least 2½ per cent. of the sum total of the Tender.
The Tenders remain binding for the Contractors during the Three Calendar Months after the date of opening.
City of Baku 5 per cent. Bonds will be accepted by the City at the price of £100 per £100 Bond as Deposit by those making Tender.
The Mayor, N. W. RAJEWSKI.
Baku.

RAWMARSH URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

THE Council are prepared to receive Separate TENDERS for the Supply of 2500 or 5000 Tons of Screened or Unscreened GAS COAL, to be delivered free at the Gas-Works, Parkgate, from Oct. 1, 1910, to March 31, 1911, or from Oct. 1, 1910, to Sept. 30, 1911.

Specification and Form of Tender may be obtained on Application to Mr. E. O. Watson, Gas-Works, Parkgate.

Tenders, endorsed "Tender for Gas Coal," to be sent to me the undersigned on or before Saturday, the 10th of September next.

The Council do not bind themselves to accept the lowest or any Tender.

By order,
J. W. BELLAMY,
Clerk to the Council.

Council Offices, Rawmarsh,
Aug. 26, 1910.

RAMSGATE CORPORATION.
(GAS AND WATER DEPARTMENT.)

THE Committee invite Tenders for the Purchase of the whole of their Surplus COKE (estimated at from 1500 to 2500 Tons) or for part, in quantities of not less than 200 Tons per Annum, from the 1st of October, 1910, to the 30th of September, 1911, delivered f.o.r. or barge Ramsgate, or free into Carts at the Gas-Works, Ramsgate—purchaser in any case to pay Dues.

Further Particulars, together with Conditions and Form of Tender, may be obtained from the undersigned.

Tenders to be sent in not later than Noon on Monday, Sept. 12, 1910, addressed to the Chairman of the Gas and Water Committee, Boundary Road, Ramsgate, endorsed "Tender for Coke."

The Committee do not bind themselves to accept the highest or any Tender.

WM. THOMSON,
Engineer and Manager.

Gas and Water Offices,
Boundary Road, Ramsgate,
August, 1910.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MESSRS. A. & W. RICHARDS beg to notify that their SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES, take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing New Capital, and also for including other Gas and Water Stocks and Shares in these Periodical Sales, will be forwarded on Application to MESSRS. A. & W. RICHARDS, at 18, FINSBURY CIRCUS, E.C.

GAS STOCK.

SALE OF DEBENTURE STOCK AND ORDINARY STOCK IN THE WESTON-SUPER-MARE GASLIGHT COMPANY.

LALONDE BROS. & PARHAM have received Instructions from the Weston-super-Mare Gaslight Company to SELL BY AUCTION, under the Provisions of the Weston-super-Mare Gas Act, 1901, at their Rooms, West Street, Weston-super-Mare, on Tuesday, the 20th of September, 1910, at Six for Seven o'clock in the Evening, subject to Conditions of Sale,

£2000
FOUR PER CENT. PERPETUAL DEBENTURE STOCK and
£3000
NEW FIVE PER CENT. MAXIMUM ORDINARY STOCK

of and in the above-named Company, in Lots of the nominal value of £50 each.

The Stocks will be Sold and Registered in the Books of the Company Free of every Expense to the Purchasers thereof.

For further Particulars and Conditions of Sale Apply to the AUCTIONEERS, High Street and Station Road, WESTON-SUPER-MARE, and 7, Royal Promenade, BRISTOL; to J. H. GRAY, Secretary to the WESTON-SUPER-MARE GASLIGHT COMPANY; or to J. H. & F. W. BERE, Solicitors, WESTON-SUPER-MARE.

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER,
Gas Engineers' Agents and Contractors for METERS, FIRE-CLAY GOODS, OXIDE OF IRON AND ALL OTHER GAS APPARATUS.
Inquiries Solicited.
Telegrams: "DARWINIAN, MANCHESTER."
Telephone 1806.

ALL the
BOYS CALORIMETERS
which have been in daily use in all the Official Testing-Stations in London for the last Three Years
WERE MADE BY
JOHN J. GRIFFIN & SONS,
— LIMITED —
KINGSWAY, LONDON, W.C.
Those desiring to obtain **Gas Calorimeters** as used in the **Official Testing Places** should see that the apparatus bears the name of the Original makers.
Descriptive Catalogue on Application.

KOPPERS' PATENT
CHAMBER OVENS.
Results obtained which have never been Surpassed by any other System of Carbonization.
Plants at Work and under Construction for the production of **18,000,000** cubic feet of Gas per Day.
See our large Advertisement appearing in alternate issues of the "JOURNAL."
The KOPPERS'
COKE OVEN AND BYE-PRODUCT CO.,
301, Glossop Road, SHEFFIELD.

JAMES OAKES & CO.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.
Manufacture and keep in Stock at their Works (also large Stock in London)
PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
NOTE.—Makers of HORSLEY SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts, and Covers, and rendering Leakage impossible.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.
QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
NEWTONGRANGE, MIDLOTHIAN.

BIRTLEY IRON COMPANY,
ESTABLISHED 1820,
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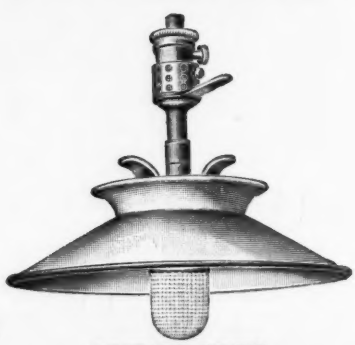
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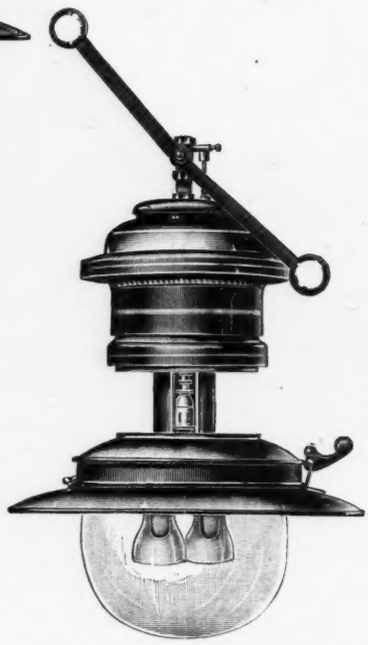

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ALL PARTS INTERCHANGEABLE.

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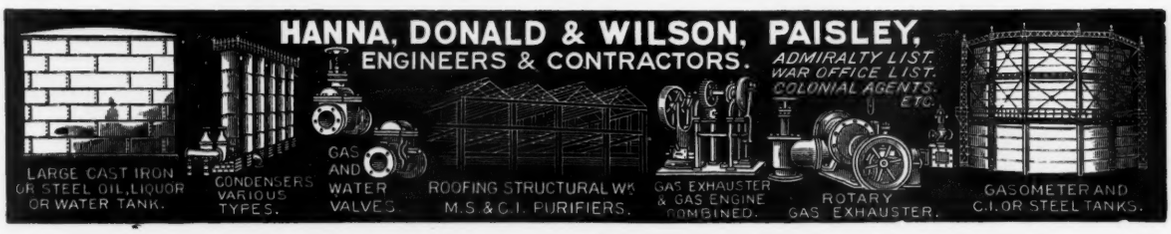
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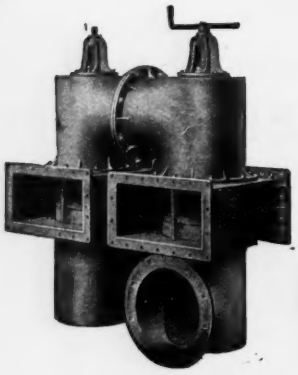

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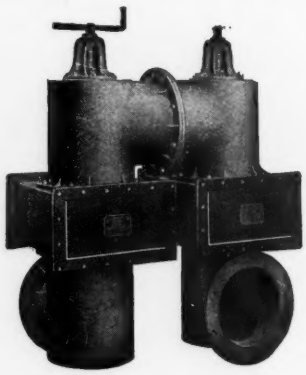
fixed inside or outside the Purifiers.



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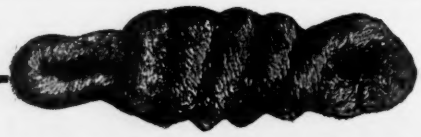

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The Lead Wool Joint is built up evenly all the way through.
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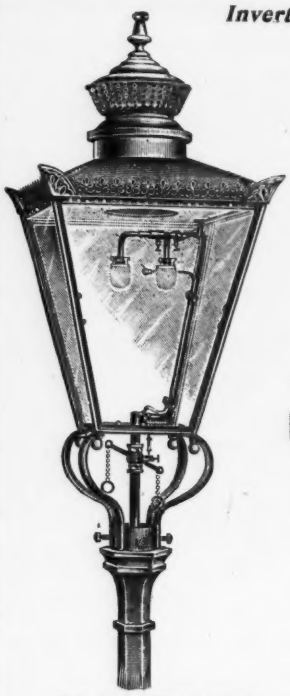

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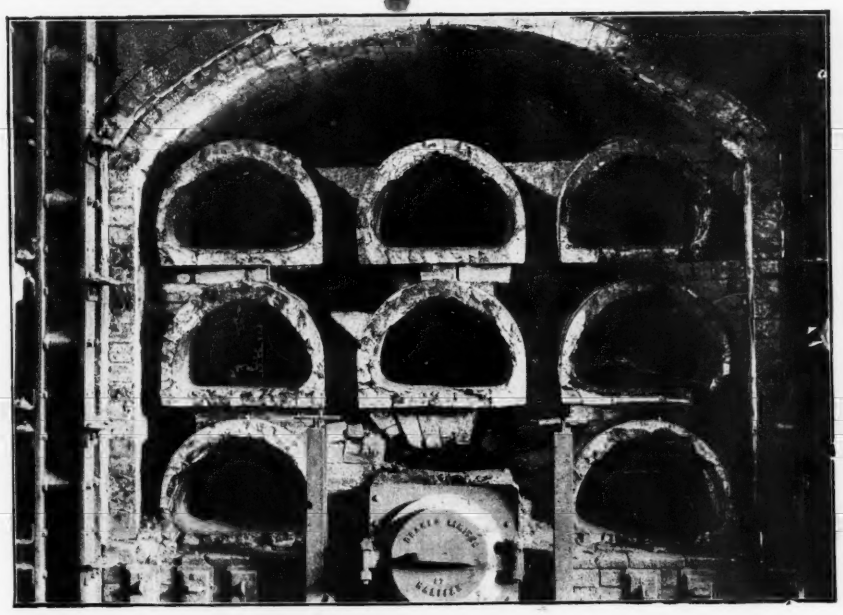

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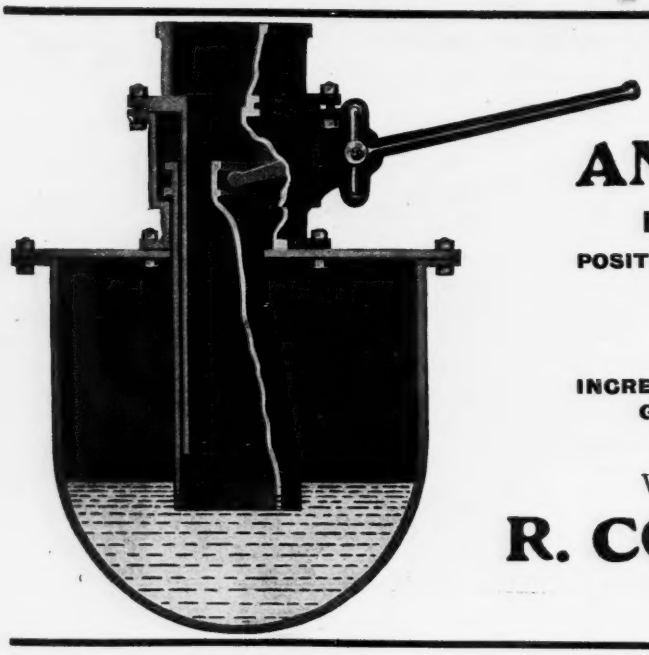

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IMPORTANT POINTS:—

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INCREASED MAKE PER TON,
GREATER ILLUMINATING POWER,
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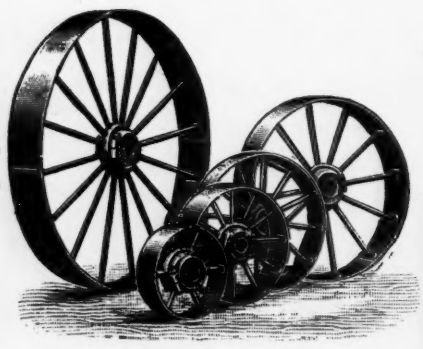

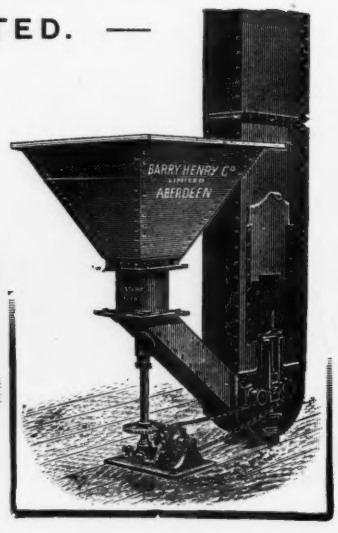

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AND

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Welsbach
LIGHT
Inverted Arc Lamp, Fig. 623.

Storm Proof—
For Exterior Lighting.

Welsbach-Kern
(Patent) Inverted System

BRITISH MADE.

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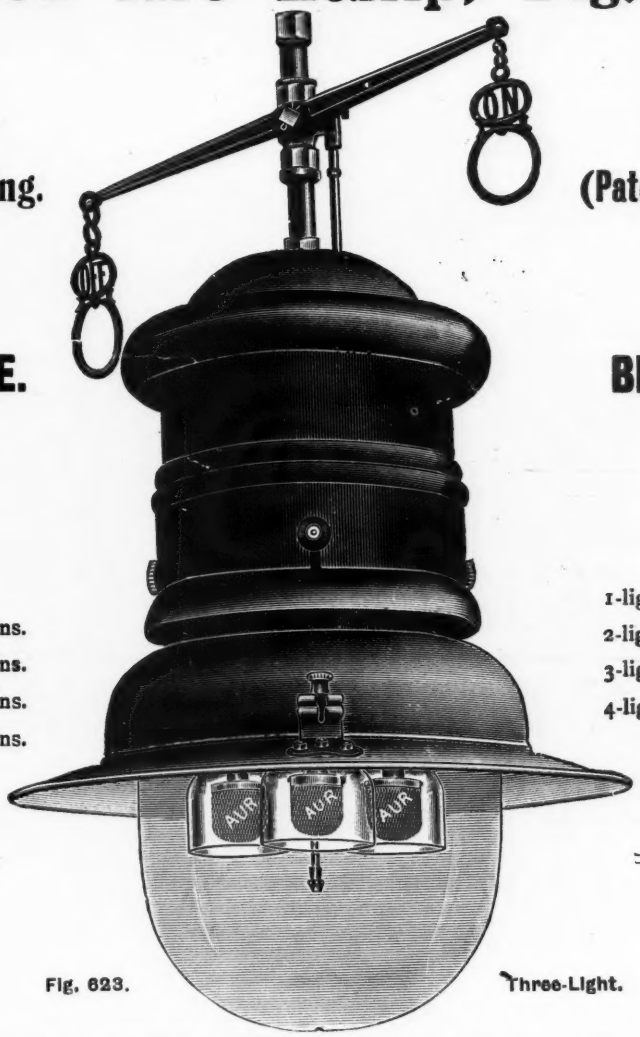

Fig. 623. Three-Light.

Height over all.

1-light . . .	1 ft. 8 ins.
2-light . . .	2 ft. 4 ins.
3-light . . .	2 ft. 4 ins.
4-light . . .	2 ft. 7 ins.

Width over all.

1-light . . .	1 ft. 1 in.
2-light . . .	1 ft. 5 ins.
3-light . . .	1 ft. 5 ins.
4-light . . .	1 ft. 8 ins.

ENAMELLED Green Steel Casing, fitted with Welsbach-Kern Inverted Burners, Gas and Air Regulators operated from outside. Sliding Door to give access to Burners for cleaning purposes. Fitted with Magnesia Nozzles, Welsbach Mantles, and Glass Mantle Protectors. Complete as shown. Highly efficient and regenerative.

	Gas per hour.	*C.P.*	*Steel.*	*Copper Case.*		*Gas per hour.*	*C.P.*	*Steel.*	*Copper Case.*
1-light	4 feet	125	**30/-**	**5/-** extra.	3-light	12 feet	400	**52/6**	**6/-** extra.
2-light	8 feet	260	**47/6**	**6/-** extra.	4-light	16 feet	550	**72/6**	**9/-** extra.

All on or off, or One light on and the rest off, **7/6** per Lamp extra. Cup and Ball, **3/6** per Lamp extra.

RENEWALS.

Glass Mantle Protectors (Fig. 623) **3/4½** per dozen, or in case lots of 5 gross, **33/-** per gross.

	1-Light.	*2-Light.*	*3-Light.*	*4-Light.*		*1-Light.*	*2-Light.*	*3-Light.*	*4-Light.*
Clear Glass Globes, each	**2/3**	**5/9**	**5/9**	**9/-**	Wired Globes, extra each	**2/-**	**2/-**	**2/9**	**3/6**
" " " In Case lots per dozen.	**19/6**	**57/9**	**57/9**	**93/-**	Parabolic Reflector, extra "	**3/6**	**6/-**	**7/6**	Not made
Case contains . .	*80*	*18*	*18*	*12*	Welsbach Mantles, each **6d.** subject as usual.				

The Welsbach Mantles for Upright lighting are "C," "CX," and "Plaissetty," price **4½d.** each.

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SILICA MACHINE MADE RETORTS.

TRADE "C.O." MARK, REGISTERED.

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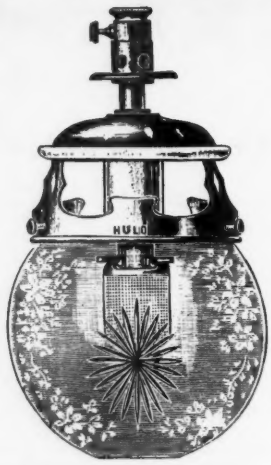

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STRONG CASH BOX

THE STRONGEST AND BEST PREVENTIVE AGAINST THEFTS FROM SLOT METERS.

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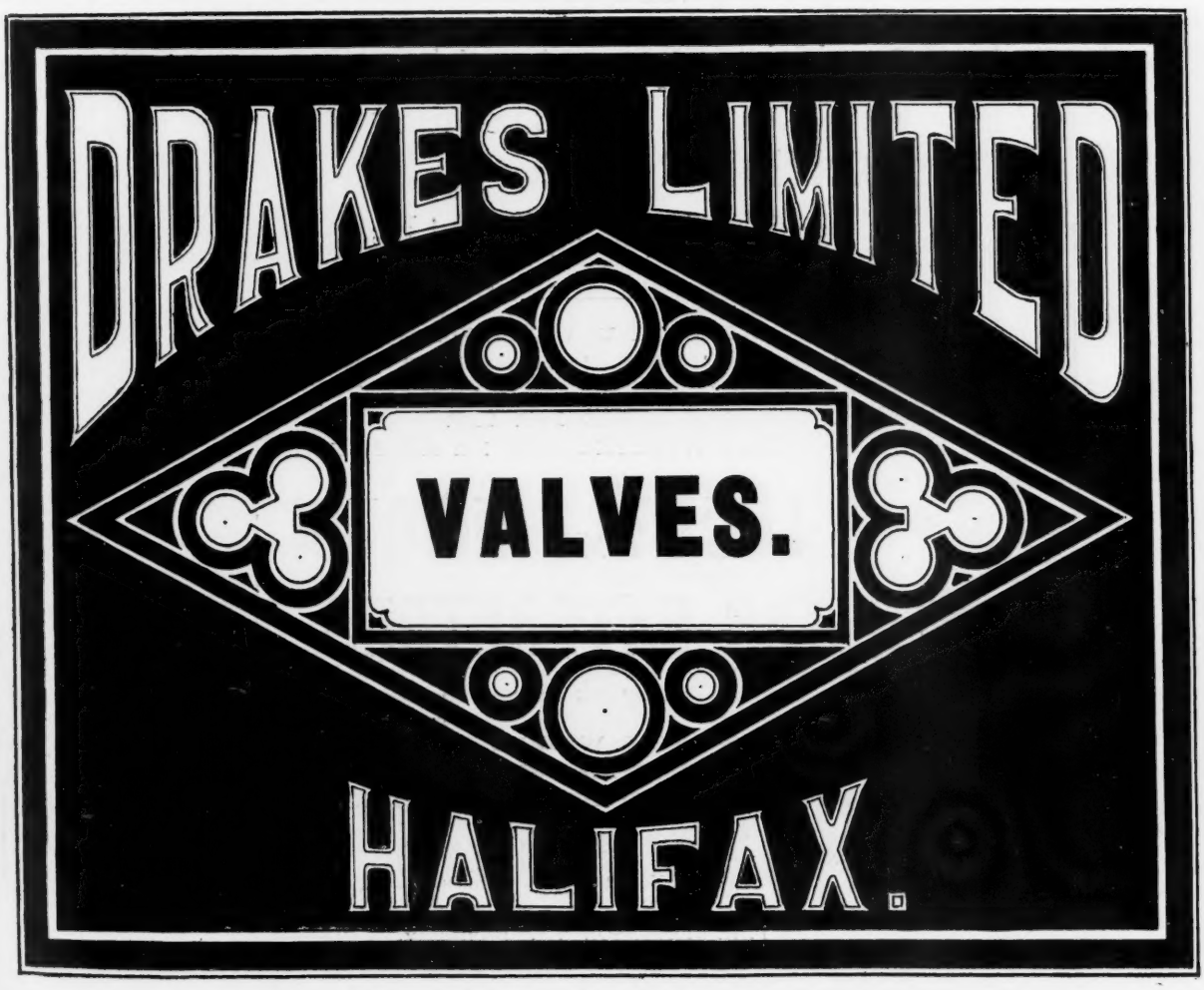

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Rotary Compressor driven by direct coupled Gas-Engine on one base.

Made in various sizes for High Pressure Lighting or Boosting District Mains, &c., and arranged for any Pressure up to 5 lbs. per square inch.

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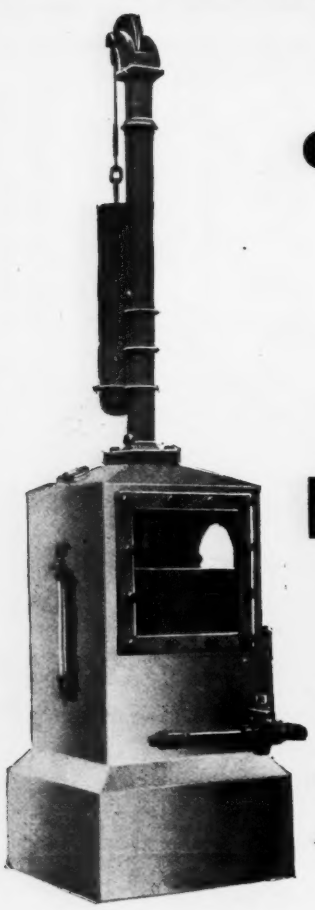

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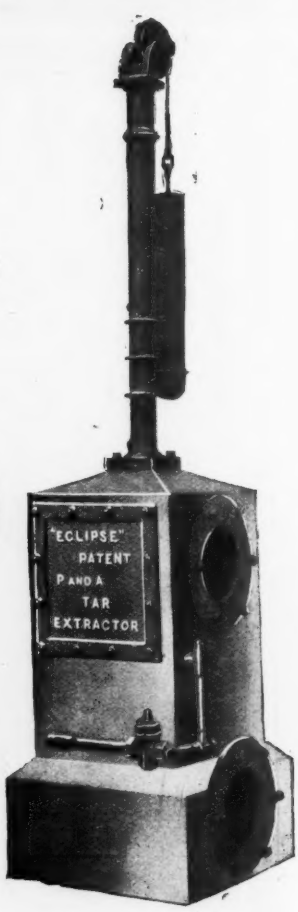

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